# 1A PROTECTIVE RELAYING TERMINAL

# TEST PROCEDURES

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## 1. GENERAL

**1.01** This practice describes test procedures for the 1A protective relaying (PR) terminal. The tests herein are made without access to components internal to the circuit packs (CPs) and modules of the terminal. Most of the tests use the built-in alarms and indicators; a few of the tests require disconnecting certain leads from the modules. None of the tests require access to internal wiring.

**1.02** Basically, the tests are divided into two categories:

- ***In-service tests*** are performed without removing the system (of which the terminal is a part) from service. In-service tests are not as comprehensive as the second category, however.

- ***Out-of-service tests*** require removing the system from service in coordination with, and with the approval of, the customer. These tests provide a comprehensive test of the entire system.

**1.03** At the time of installation, both the in-service and the out-of-service tests are to be performed.

**1.04** Perform only those tests that apply to a particular site or system configuration, as identified in the In-Service Test and Out-of-Service Test paragraph headings. For example, ***do not*** attempt to perform a dual-channel system trip test on a single-channel system.

**1.05** The tests are presented in step-procedure format. If a particular step should fail, refer to the correspondingly numbered step in Part 5 (TROUBLESHOOTING).

**1.06** Because of the unusually high reliability of the integrated circuits and components used in the PR terminal, no routine tests are specified to be performed by telephone company (Telco) personnel. However, the customer may elect to perform in-service tests and the out-of-service trip test on a routine basis as deemed necessary. Such tests should not exceed seven per week because of possible interference on adjacent telephone channels.

## 2. SPECIAL TOOLS AND APPARATUS

**2.01** A KS-20538 volt-ohm-milliammeter (VOM), or equivalent, is required for certain tests specified in this practice.

**2.02** A 1500-ohm, 30-watt, WE 44U resistor, or equivalent, is required for making the end-to-end tests described herein.

**2.03** A screw-starting screwdriver, such as Kedman No. 1736, No. 2356 (or equivalent) will be helpful in mounting a transceiver or interface mounting unit in the event either is replaced.

**2.04** Four short jumpers made of 18 to 22 AWG wire (3 or 4 inches long) with an alligator clip on each end are required for certain specified tests.

## 3. IN-SERVICE TESTS

**3.01** ***Verify System Normal—All Systems:*** This test applies to all terminals of all types of systems (unidirectional, bidirectional, multipoint, single channel, and dual channel). This test verifies that the dc potentials are present at the terminal and that supervisory carrier is present.

**3.02** ***Procedure:***

| STEP | PROCEDURE |
|---|---|
| 1 | Observe that ***only*** +15V and −15V lamps on transmitter(s) are lighted. |
| 2 | Observe that ***only*** +15V, −15V, and SUPV CARR PRES lamps on receiver(s) are lighted. |

**3.03** ***Remote Line Fail Test—All Transmit Terminals:***


***It is not mandatory that all steps be performed sequentially. However, if not starting at the beginning, perform Steps 1 and 2 (ie, verify system is normal) before proceeding with other tests.***

**3.04** ***Procedure:***

| STEP | PROCEDURE |
|---|---|
| 3 | Operate the GUARD OFF switch on transmitter for about three seconds. Observe that after a delay of about one second, the REM LINE FAIL lamp on receiver lights. Observe that REM LINE FAIL lamp extinguishes one to three seconds after GUARD OFF switch is released. |

**3.05** ***Trip Test—All Transmit Terminals:*** This test automatically tests the capability of all links of the system to transmit and detect the enhanced trip and the trip hold signals in two stages. Transmission of the high-frequency trip tone (2730 Hz) is tested first, followed by transmission of the low-frequency trip tone (2130 Hz). If the high-frequency test is unsuccessful, the low-frequency test is not attempted by the transmitter.

**3.06** ***Procedure:***

| STEP | PROCEDURE |
|---|---|
| 4 | Perform Steps 1 and 2 to verify system is normal. This test cannot be performed unless Steps 1 and 2 are satisfactory. |
| 5 | Operate and hold TEST switch on transmitter. Observe that HF OK and TEST OK lamps light immediately when TEST switch is operated. |
| 6 | Release TEST switch. Observe that HF OK and TEST OK lamps extinguish momentarily. Observe that HF OK lamp lights in about 0.5 second, followed shortly by TEST OK lamp which lights for about one second.<br><br>***Note:*** Time intervals are not critical and vary by type of system. |

## 4. OUT-OF-SERVICE TESTS

**4.01** The following tests are to be made on an out-of-service basis. The out-of-service tests are more comprehensive than the in-service tests and are performed at the time of installation and for trouble isolation. The trip tests (Steps 7 through 42) may also be performed on a routine basis.


***Placing the system in service initially and subsequent removing and placing the system back in service require coordination with all sites and with the customer.***

**4.02** To avoid false trips, out-of-service tests require taking all terminals of a two-point or multipoint system out of service even though not all of the receivers associated with a transmitter are being tested. A receiver (or receivers of a dual-channel system) is taken out of service by operating the NORMAL—TEST switch on the trip output module to TEST position. A transmitter (or transmitters of a dual-channel system) is taken out of service by operating the ON LINE—TEST switch on the keying input module to TEST SP position. Other test positions also take the system out of service, but make it vulnerable to transmission of trip signals when the TRIP TEST switch is operated. [The only test requiring disconnection of the customer keying circuit at the transmitter and the customer trip circuit at the receiver is the end-to-end test in 4.33 (Steps 84 to 95)].

**4.03** Coordination between sites is required for most of the following tests. Establish voice communication between all sites within the system.

**4.04** ***Trip Test—All Single-Channel Systems:*** This test is more comprehensive than the in-service trip test in that it includes tests of the keying input circuit at the transmitter and the trip output circuit at the receiver. In a multipoint system, this test may be applied to a transmitter and one receiver, or it may be applied to a transmitter and all associated remote receivers at the same time.

**4.05** In a unidirectional system, the test is initiated at the transmitting site. Responses are received at the receiving site and must be reported to the transmitting site. In a bidirectional system, the test may be performed first from the local transmitter, and then from the far-end transmitter, to test both directions of transmission.

**4.06** ***Procedure:***

| STEP | PROCEDURE |
|---|---|
| 7 | Perform Steps 1 and 2 to verify system is normal. This test cannot be performed unless Steps 1 and 2 are satisfactory. |
| 8 | At receiving end, operate NORMAL—TEST switch on receiver trip output module to TEST position. |
| 9 | If option F is used, place jumper across terminals 8 and 9 on TS M of receiver trip output module. |
| 10 | At transmitting end, operate ON LINE—TEST switch on keying input module to TEST A. |
| 11 | At transmitting end, operate TRIP TEST switch on keying input module for about five seconds. |
| 12 | At receiving end, observe that TRIP TEST lamp lights on receiver trip output module and observe that TRIP lamp on receiver control panel is lighted.<br><br>***Note:*** If receiver trip output module is a J1G030GD,L1 (2A), the TRIP TEST lamp should remain lighted only while trip signal is being received. If module is a J1G030GD,L2 (30A), the TRIP TEST lamp should remain on until extinguished by momentarily operating TEST RLS switch on receiver trip output module. |
| 13 | At receiving end, observe that TRIP lamp on the alarm module lights and that audible signal operates. |
| 14 | At transmitting end, observe that REM TRIP lamp on associated receiver is lighted. |
| 15 | At receiving end, momentarily operate trip RELEASE switch on receiver. Observe that TRIP lamp on receiver and on alarm module are extinguished. |
| 16 | At transmitting end, observe that REM TRIP lamp on supervisory receiver is extinguished.<br><br>***Note:*** In multipoint systems, Steps 12 through 16 apply to all distant receivers associated with transmitter under test. Also, at transmitter under test, the REM TRIP lamps on all receivers associated with distant stations will be lighted. They will be extinguished when trip RELEASE switches at distant receivers are operated. |
| 17 | After test is completed, remove jumper from TS M, terminals 8 and 9. |

| STEP | PROCEDURE |
|---|---|
| 18 | If further tests are to be performed for installation or troubleshooting, proceed to 4.13. Otherwise, in coordination with the customer and all sites, return system to service as follows:<br><br>(a) At transmitting end, operate ON LINE—TEST switch on keying input module to ON LINE.<br><br>(b) At receiving end, operate NORMAL—TEST switch on receiver trip output module to NORMAL. |

**4.07** ***Trip Test—Dual-Channel System—OR (Parallel) Operation:*** This test is more comprehensive than the in-service trip test in that it includes tests of the keying input circuit at the transmitter and the trip output circuit at the receiver.

**4.08** In a unidirectional system, the test is initiated at the transmitting site. Responses are received at the receiving site and must be reported to the transmitting site. In a bidirectional system, the test may be performed first from the local transmitter, and then from the far-end transmitter, to test both directions of transmission.

**4.09** ***Procedure:***

| STEP | PROCEDURE |
|---|---|
| 19 | At receiving end, verify that CHAN SELECT switch on receiver "A" is in DUAL position. |
| 20 | To test channel "A" alone, follow procedures in Steps 7 through 17. |
| 21 | To test channel "B" alone, operate the ON LINE—TEST switch on keying input module to TEST B, then follow Steps 7 through 17 as for a single-channel system. |
| 22 | To test both channels simultaneously, operate ON LINE—TEST switch on keying input module to TEST A+B, then follow Steps 7 through 17 as for a single-channel system. |
| 23 | If further tests are to be made for installation or troubleshooting, proceed to 4.13. Otherwise, in coordination with the customer and all sites, return system to service as follows:<br><br>(a) At transmitting end, operate ON LINE—TEST switch on keying input module to ON LINE.<br><br>(b) At receiving end, operate NORMAL—TEST switch on receiver trip output module to NORMAL. |

**4.10** ***Trip Test—Dual-Channel System—AND (Series) Operation:*** This test is more comprehensive than the in-service trip test in that it includes tests of the keying input circuit at the

transmitter and the trip output circuit at the receiver.

**4.11** In a unidirectional system, the test is initiated at the transmitting site. Responses are received at the receiving site and must be reported to the transmitting site. In a bidirectional system, the test may be performed first from the local transmitter, and then from the far-end transmitter, to test both directions of transmission.

**4.12** ***Procedure:***

| STEP | PROCEDURE |
|---|---|
| 24 | At receiving end, set NORMAL—TEST switch on receiver trip output module to TEST. Set CHAN SELECT switch on receiver "A" to DUAL. |
| 25 | If option F is used, place jumper across terminals 8 and 9 of TS M on receiver trip output module. |
| 26 | At transmitting end, operate ON LINE—TEST switch on keying input module to TEST A. |
| 27 | At transmitting end, operate TRIP TEST switch on the keying input module for about five seconds. |
| 28 | At receiving end, observe that TRIP lamp on receiver "A" lights and remains lighted. Also, observe that TRIP TEST lamp on trip output module ***does not*** light. Operate RELEASE switch on receiver to extinguish TRIP lamp. |
| 29 | At transmitting end, operate TRIP TEST switch on the keying input module, and disable channel "B" by operating transmitter "B" GUARD OFF switch simultaneously for about five seconds. |
| 30 | At receiving end, observe that TRIP TEST lamp on receiver trip output module, LINE FAIL lamp on receiver "B", and ALM lamp on alarm module are lighted.<br><br>***Note:*** If a J1G030GD,L1 (2A) receiver trip output module is provided, TRIP TEST lamp should remain on only while trip signal is being received. If the J1G030GD,L2 (30A) trip output module is provided, TRIP TEST lamp should remain on until extinguished by momentarily operating TEST RLS switch on receiver trip output module. |
| 31 | At receiving end, observe that TRIP lamp on receiver "A" lights and remains lighted. |
| 32 | Observe that TRIP lamp on the alarm module lights and that audible alarm operates. |
| 33 | At transmitting end, observe that REM TRIP lamp on associated receiver is lighted. |
| 34 | At receiving end, momentarily operate trip RELEASE switch on receiver "A". Observe that TRIP lamps on the receiver and the alarm module are extinguished. |
| 35 | At transmitting end, observe that REM TRIP lamp on supervisory receiver is extinguished. |
| 36 | Operate ON LINE—TEST switch on keying input module to TEST B. Repeat Steps 27 through 35 to test channel "B". At step 28, observe that TRIP lamp on receiver "B" lights and remains lighted. At Step 29, disable channel "A" by operating GUARD OFF |

| STEP | PROCEDURE |
|---|---|
| | switch on transmitter "A". At Step 30, observe that LINE FAIL lamp on receiver "A" is lighted. |
| 37 | At transmitting end, operate ON LINE—TEST switch on keying input module to TEST A+B. |
| 38 | Operate TRIP TEST switch on keying input module for about five seconds. |
| 39 | At receiving end, observe that TRIP TEST lamp lights on receiver trip output module. |
| 40 | Operate trip RELEASE switch on both receivers to extinguish TRIP lamps. Operate TEST RLS switch on receiver trip output module to extinguish TRIP TEST lamp if it remains lighted. |
| 41 | After test is completed, remove jumper from TS M, terminals 8 and 9. |
| 42 | If further tests are to be made for installation or troubleshooting, proceed to 4.13. Otherwise, in coordination with the customer and all sites, return system to service as follows:<br>(a) At transmitting end, operate ON LINE—TEST switch on keying input module to ON LINE.<br>(b) At receiving end, operate the NORMAL—TEST switch on receiver trip output module to NORMAL. |

**4.13** ***Trip Hold Test—All Systems:*** This test tests the capability of the receiver to (a) maintain a trip output during transmission of a trip hold signal, (b) turn off the trip output when the trip hold signal is lost, and (c) turn on the trip output when the trip hold signal is received without being preceded by an enhanced trip signal. In multipoint systems, this test may be performed simultaneously at all distant receivers associated with a transmitter. In a dual channel system, the two channels may be tested one at a time or they may be tested simultaneously.

**4.14** ***Procedure:***

| STEP | PROCEDURE |
|---|---|
| 43 | Perform Steps 1 and 2 to verify system is normal. This test cannot be performed unless Steps 1 and 2 are satisfactory. |
| 44 | At distant transmitter, operate and hold TRIP TEST switch on keying input module for duration of this test. |
| 45 | Observe that TRIP lamp on local receiver is lighted. |

| STEP | PROCEDURE |
|---|---|
| 46 | Operate and hold associated trip RELEASE switch. Observe that TRIP lamp remains lighted. |
| 47 | With trip RELEASE switch still operated, open the telephone line by removing lead on TS C, terminal 18. Observe that TRIP lamp is extinguished. |
| 48 | Replace lead on TS C, terminal 18. Observe that TRIP lamp is relighted. |
| 49 | At distant transmitting terminal, release TRIP TEST switch. |
| 50 | At local receiver, release trip RELEASE switch. Momentarily operate TEST RLS switch on receiver trip output module if TRIP TEST lamp on module is lighted. |
| 51 | If further tests are to be performed for installation or troubleshooting, proceed to 4.15. Otherwise, in coordination with the customer and all sites within the system, return system to service as follows:<br>(a) At transmitting end, operate the ON LINE—TEST switch on the keying input module to ON LINE.<br>(b) At receiving end, operate the NORMAL—TEST switch on trip output module to NORMAL. |

**4.15** ***Miscellaneous Alarm Tests—General:*** The purpose of these tests is to verify the operation of the alarm module and the various alarm outputs of the receiver(s), transmitter(s), and keying input module of which the terminal and system are comprised. The system must be out of service for these tests. Refer to the precautions in 4.01 through 4.03. The steps vary in detail, depending on the type of system involved. However, Steps 52 through 54 apply to all system configurations for these tests.

**4.16** ***Procedure:***

| STEP | PROCEDURE |
|---|---|
| 52 | Perform Steps 1 and 2 to verify system is normal. The alarm tests cannot be made unless Steps 1 and 2 are satisfactory. |
| 53 | On alarm module, operate TRIP switch to DISABLE. Operate ALM and AUD ALM switches to NORMAL. |
| 54 | Observe that ALARM DISABLE lamp on interface control panel is lighted, and TRIP and ALM lamps on alarm module are extinguished. |

**4.17** ***Remote Line Fail and Line Fail Alarm Tests—2-Point Bidirectional System:*** Steps 1, 2, 53, and 54 must have been completed before proceeding with these tests.

**4.18** ***Procedure:***

| STEP | PROCEDURE |
|---|---|
| 55 | At local transmitter, connect jumper between TS F, terminals 11 and 4 (ground). |
| 56 | Operate GUARD OFF switch on local transmitter. Make the following observations locally.<br>(1) REM LINE FAIL lamp on receiver is lighted.<br>(2) ALM lamp on alarm module is lighted.<br>(3) SYSTEM ALARM lamp on interface control panel is lighted.<br>(4) Audible alarm operates.<br>(5) Remote alarms (if provided) operate. |
| 57 | Momentarily operate AUD ALM switch to DISABLE and observe that audible alarm ceases. |
| 58 | Release GUARD OFF switch on transmitter. Observe that after a short delay the REM LINE FAIL, ALM, and SYSTEM ALARM lamps are extinguished. |
| 59 | At distant transmitter, operate GUARD OFF switch for several seconds. At local terminal, observe that LINE FAIL lamp on receiver and ALM lamp on alarm module and SYSTEM ALARM lamp on interface control panel light while distant GUARD OFF switch is operated. |
| 60 | Remove jumper from TS F, terminals 11 and 4. |
| 61 | Repeat Steps 55 through 60 at other site of bidirectional system. |

**4.19** ***Remote Line Fail Alarm Test—2-Point Unidirectional System—Transmit Terminal:*** Steps 1, 2, 53, and 54 must have been completed before proceeding with these tests.

**4.20** ***Procedure:***

| STEP | PROCEDURE |
|---|---|
| 62 | For this test, perform Steps 55 through 58 and 60. |

**4.21** ***Remote Line Fail and Line Fail Alarm Tests—Multipoint Unidirectional System—Transmit Terminal:*** Steps 1, 2, 53, and 54 must have been completed before proceeding with this test.

**4.22** ***Procedure:***

| STEP | PROCEDURE |
|---|---|
| 63 | At local transmitter, connect jumper between TS F, terminals 11 and 4 (ground). Place jumpers on terminals 2 and 3 of TS B on all receivers except one. |
| 64 | At local transmitter, operate GUARD OFF switch. Observe the following:<br>(1) REM LINE FAIL lamp on unstrapped receiver is lighted. (REM LINE FAIL lamp on other receivers will also light.)<br>(2) ALM lamp on alarm module is lighted.<br>(3) SYSTEM ALARM lamp on interface control panel is lighted.<br>(4) Audible alarm on alarm module operates.<br>(5) Remote alarms (if provided) operate. |
| 65 | Momentarily operate AUD ALM switch to DISABLE and observe that audible alarm ceases. Release GUARD OFF switch. Observe that after a short delay the REM LINE FAIL, ALM, and SYSTEM ALARM lamps are extinguished. |
| 66 | Transfer jumper on TS B, terminals 2 and 3, of one of the jumpered receivers to the receiver just tested. Repeat Steps 64 and 65 to test unjumpered receiver. Continue transferring jumper and performing Steps 64 and 65 until all receivers are tested. Leave jumper in place for signal fail alarm test (4.27). |

**4.23** ***Remote Line Fail and Line Fail Alarm Tests—Multipoint Symmetrical System—All Sites:*** Steps 1, 2, 53, and 54 must have been completed before proceeding with this test.

**4.24** ***Procedure:***

| STEP | PROCEDURE |
|---|---|
| 67 | At local transmitter, connect a jumper between TS F, terminals 11 and 4 (ground). Place jumper on terminals 2 and 3 of TS B on all receivers except one. |

| STEP | PROCEDURE |
|---|---|
| 68 | At local transmitter, operate GUARD OFF switch. Observe the following:<br>(1) REM LINE FAIL lamp on unjumpered receiver is lighted. (REM LINE FAIL on other receivers will also light.)<br>(2) ALM lamp on alarm module is lighted.<br>(3) SYSTEM ALARM lamp on interface control panel is lighted.<br>(4) Audible alarm on alarm module operates.<br>(5) Remote alarms (if provided) operate. |
| 69 | Momentarily operate AUD ALM switch to DISABLE and observe that audible alarm ceases. Release GUARD OFF switch. Observe that after a short delay the REM LINE FAIL, ALM, and SYSTEM ALARM lamps are extinguished. |
| 70 | At distant transmitter associated with receiver under test, operate GUARD OFF switch for several seconds. At local terminal, observe that LINE FAIL and ALM lamps light while GUARD OFF switch is operated. |
| 71 | Transfer jumper on TS B, terminals 2 and 3, of one of the jumpered receivers to the receiver just tested. Repeat Steps 68, 69, and 70 to test unjumpered receiver. Continue transferring jumper and performing Steps 68, 69, and 70 until all receivers are tested. Leave jumper in place for signal fail alarm test (4.27). |

**4.25** ***Line Fail Alarm Test—2-Point or Multipoint Unidirectional System—Receive Terminal:*** Steps 1, 2, 53, and 54 must have been completed before proceeding with this test.

**4.26** ***Procedure:***

| STEP | PROCEDURE |
|---|---|
| 72 | At the distant transmitting terminal, operate and hold GUARD OFF switch. At local terminal, make the following observations.<br>(1) LINE FAIL lamp on receiver is lighted.<br>(2) ALM lamp on alarm module is lighted.<br>(3) SYSTEM ALARM lamp on interface control panel is lighted.<br>(4) Audible signal on alarm module operates.<br>(5) Remote alarms (if provided) operate. |

| STEP | PROCEDURE |
|---|---|
| 73 | Momentarily operate AUD ALM switch to DISABLE and observe that audible alarm ceases. |
| 74 | Release GUARD OFF switch at distant terminal. Observe that after a short delay the LINE FAIL, ALM, and SYSTEM ALARM lamps at local terminal are extinguished. |

**4.27** ***Signal Fail Alarm Test—All Transmit Terminals:*** Steps 1, 2, 53, and 54 must have been completed before proceeding with this test.

**4.28** ***Procedure:***

| STEP | PROCEDURE |
|---|---|
| 75 | Place jumpers on terminals 2 and 3 of TS B on all receivers of the terminal. |
| 76 | Operate GUARD OFF switch on transmitter for several seconds. Observe that SIG FAIL lamp on transmitter and ALM lamp on alarm module light while switch is operated. |
| 77 | Remove jumpers from TS B, terminals 2 and 3, of all receivers. |

**4.29** ***Keying Input SP Fuse Alarm Test—All Transmit Terminals:*** Steps 1, 2, 53, and 54 must have been completed before proceeding with this test. This test verifies the operation of the FA fuse alarm.

**4.30** ***Procedure:***

| STEP | PROCEDURE |
|---|---|
| 78 | Operate ON LINE—TEST switch on keying input module to TEST SP. Remove FA fuse on keying input module and replace it with an open fuse. |
| 79 | Operate TRIP TEST switch on keying input module for several seconds. Observe that FA lamp on keying input module and ALM lamp on alarm module light while TRIP TEST switch is operated. |
| 80 | Remove open FA fuse and replace it with a "good" fuse. |
| 81 | Operate TRIP switch on alarm module to NORMAL. Operate ON LINE—TEST switch on keying input module to ON LINE. |

**4.31** ***Surge Protection Test—All Transmit Terminals:*** This test provides for verification of the surge protection cicuitry in the keying input module associated with the transmitter(s) of single- or dual-channel systems.

***Note:*** This test requires the system to be out of service, but no attendant is required at the receive terminal(s). ***Customer approval is required for removing the system from service.***

**4.32** ***Procedure:***

| STEP | PROCEDURE |
|---|---|
| 82 | Operate ON LINE—TEST switch on keying input module to TEST SP. Operate and release TRIP TEST switch on keying input module several times. Observe that SP lamp flashes each time TRIP TEST switch is operated, but does not light steadily if TRIP TEST switch is held operated. |
| 83 | After test is completed, operate ON LINE—TEST switch on keying input module to ON LINE. |

**4.33** ***End-to-End Test—All Systems:*** This test is intended primarily as a final test of the system. Before performing this test, the system should have met the applicable tests specified in Steps 1 through 40. The system should be removed from, and returned to, service in accordance with 4.01 through 4.03.

**4.34** In a multipoint system, a transmitter and all associated remote receivers may be tested at the same time if required. Even though the testing of all distant receivers associated with a transmitter may not be required, those receivers not being tested must have the NORMAL—TEST switch on the receiver trip output module placed in TEST position if the customer trip circuits are connected.

***WARNING: In the following procedure, avoid contact with leads which may present a shock hazard.***

**4.35** ***Procedure:***

| STEP | PROCEDURE |
|---|---|
| 84 | At the receive terminal, if the customer trip circuit is connected to the trip output module, request the customer to disable it. After the trip circuit is disabled, disconnect the trip circuit leads from TS N, terminals 1 and 2. |
| 85 | At transmit terminal, operate ON LINE—TEST switch on keying input module to TEST SP. Remove AUX POWER POS and NEG fuses from converter input module. If the customer keying circuit is connected to the keying input module, request the customer to disable it. |

| STEP | PROCEDURE |
|---|---|
| 86 | After the keying input circuit is disabled, disconnect the keying input leads from TS K, terminals 3 and 4. Connect two jumpers as shown in Fig. 1. Replace AUX POWER POS and NEG fuses. |
| 87 | At distant receive terminal, remove AUX POWER POS and NEG fuses from converter input module. Connect a jumper and a WE 44U 1500-ohm, 30-watt resistor (or equivalent) as shown in Fig. 2. |
| 88 | Prepare VOM to measure dc volts on 300-volt scale. Connect VOM across resistor as shown in Fig. 2. |
| 89 | Replace AUX POWER POS and NEG fuses in converter input module. |
| 90 | At distant receiver, operate NORMAL—TEST switch on receiver trip output module to NORMAL. Observe that VOM indicates zero volts. |
| 91 | At transmitter, operate ON LINE—TEST switch on keying input module to ON LINE. Observe that VOM at receive site indicates station battery voltage. |
| 92 | At transmitter, operate ON LINE—TEST switch on keying input module to TEST SP. |
| 93 | If trip output module at receive terminal is a J1G030GD,L1 (2A), the VOM should now indicate zero. |
| 94 | If trip output module is a J1G030GD,L2 (30A), station battery voltage should still be indicated on the VOM. Operate NORMAL—TEST switch to TEST, then back to NORMAL. Observe that VOM indicates zero.<br><br>***Caution: Avoid prolonged current flow through resistor. Also, avoid touching resistor during or immediately after test, as the resistor will become hot during test.*** |
| 95 | Remove AUX POWER POS and NEG fuses at transmitter and receiver. Remove jumpers, resistor, and VOM connected in Steps 86 through 88. Replace AUX POWER POS and NEG fuses. |

**4.36** ***Completion of Initial Installation Tests:*** If the tests just completed were performed in connection with an initial installation, refer to Section 024-195-200 for making final wiring connections and turning the system over to the customer.

**4.37** ***Completion of Post-Installation Tests:*** If the tests just completed were performed in connection with troubleshooting a malfunctioning system, return the system to service in coordination with the customer and all sites within the system.

## 5. TROUBLESHOOTING

**5.01** This part provides guidance in isolating trouble which has appeared in performing the tests described in Parts 3 and 4.

**5.02** When a trouble has occurred in peforming the test procedures, refer to the corresponding step number in this part to begin trouble isolation. When the trouble appears to be cleared, return to the step in the test procedures where the trouble was encountered, and repeat that and subsequent tests.

**5.03** Since troubleshooting steps cover more detail than the steps in the test procedures, it is necessary in some cases to use several troubleshooting steps to cover one test step. In such cases, the troubleshooting steps are numbered with the same basic number as the test step number, ***plus*** a letter suffix to the basic number. For example: The troubleshooting procedure corresponding to Step 3 has two parts, identified as 3a and 3b.

**5.04** Some of the steps in the test chart (Parts 3 and 4) specify procedure and do not require an indication; therefore, some steps are blank in the troubleshooting chart.

**5.05** Due to the simplicity of the alarm circuitry, troubleshooting procedures related to alarm tests have been omitted.

**5.06** The troubleshooting chart lists the control or indicator, the ***correct*** condition of the control or indicator for that step, and the probable cause of the trouble if the correct condition is not met.

**5.07** In each case where CP replacement is required in troubleshooting, remove power by removing converter input POS or NEG fuse before removing CP. Replace fuse after CP has been replaced.

**5.08** Troubleshooting for in-service tests, as well as out-of-service tests, must be carried out on an out-of-service basis because unit replacements are involved. This requires that the system be taken out of service as described in 4.02. Clearing trouble associated with the end-to-end test (4.33) requires that the customer keying and trip circuits be disconnected as described in Steps 84 through 86.

TROUBLESHOOTING CHART

| STEP | CONTROL OR INDICATOR | NORMAL CONDITION | PROBABLE CAUSE AND/OR CORRECTIVE ACTION |
|---|---|---|---|
| 1 | +15V lamp<br>−15V lamp | lighted<br>lighted | A. If one or more, but not all, lamps are extinguished, check for defective output fuse(s) in fuse and converter module. |
| 2 | +15V lamp<br>−15V lamp<br>SUPV CARR PRES lamp<br>All other lamps | lighted<br>lighted<br>lighted<br>extinguished | B. If all lamps are extinguished, check for defective fuse(s) in converter input module and the CONVERTER INPUT fuses in the fuse and converter module. |
| | | | C. Check station battery input voltage. |
| | | | D. If SIG FAIL lamp on transmitter is lighted, replace CP-1 (AA). |
| | | | E. If TRIP lamp on receiver is lighted, operate RELEASE switch on receiver to extinguish lamp. |
| | | | F. If REM TRIP lamp is lighted, operate RELEASE switch on associated distant receiver to extinguish lamp. |
| | | | G. If LINE FAIL lamp is lighted, verify receive line by monitoring for noise, using the 1013A handset. Also verify received level of guard tone using VOM. Make tests by connecting to terminals 17 and 18 of TS C. Guard signal should be received at a level of −16 to −22 dBm. |
| | | | H. If SUPV CARR PRES lamp is extinguished and LINE FAIL lamp is also extinguished, trouble in local supervisory receiver or in associated distant supervisory transmitter is indicated. Verify received level of supervisory signal as in G above. If testing at transmitting terminal of a unidirectional system, no action is required at distant terminals while making this measurement. If testing at a bidirectional terminal, remove guard tone by operating GUARD OFF switch at distant transmitter while making supervisory signal measurement. The supervisory signal should appear on terminals 17 and 18 of TS C at a level of −26 to −32 dBm. If signal is within this |

TROUBLESHOOTING CHART

| STEP | CONTROL OR INDICATOR | NORMAL CONDITION | PROBABLE CAUSE AND/OR CORRECTIVE ACTION |
|---|---|---|---|
| | | | range, replace CP-6 (DA) in the receiver. If the supervisory signal is *not* received within this range, but guard signal was received satisfactorily, replace CP-2 (BA) in distant transmitter. |
| | | | I. If REM LINE FAIL lamp is lighted, perform the same procedure *at distant receiver* (as described in H) for LINE FAIL at local receiver. |
| 3a | REM LINE FAIL lamp | lights when local GUARD OFF switch is operated | A. Replace CP-6 (DA) in local receiver on which failure occurs. If this does not clear trouble, try replacing receiver control panel. If this does not clear trouble, assistance is required at distant receiver. Proceed to Step 3b. |
| 3b | LINE FAIL lamp at distant rcvr. | lights when local GUARD OFF switch is operated | B. If LINE FAIL lamp lights at distant receiver, replace CP-2 (BA) at distant receiver. If LINE FAIL lamp *does not* light at distant receiver, replace CP-5 (CC) at distant receiver. Verify test after CP has been replaced to see if trouble has been cleared. |
| 4 | — | — | — |
| 5 | HF OK and TEST OK lamps | Both lamps lighted immediately | A. CP-2 (BA) possibly defective. Replace. Verify test after CP has been replaced to see if trouble has been cleared. |
| | | | B. Test switch on supervisory transmitter possibly defective. Replace transmitter control panel. Verify test after control panel has been replaced to see if trouble has been cleared. |
| | | | C. Failure of only one lamp indicates possibly defective lamp, or defective CP-2 (BA). Try replacing CP-2 first. If this *does not* clear trouble, replace transmitter control panel. Verify test after CP or control panel has been replaced to see if trouble has been cleared. |

TROUBLESHOOTING CHART

| STEP | CONTROL OR INDICATOR | NORMAL CONDITION | PROBABLE CAUSE AND/OR CORRECTIVE ACTION |
|---|---|---|---|
| | | | ALL SYSTEMS |
| 6 | HF OK and TEST OK lamps | Both extinguished, followed by HF OK lighting, followed by TEST OK lighting | A. If both lamps fail to light, failure of HF trip tone test is indicated. Transmitter will not initiate low-frequency trip tone test if HF test fails. If HF OK lamp lights but TEST OK lamp fails to light, failure of LF trip tone test is indicated. |
| | | | TWO-POINT BIDIRECTIONAL SYSTEM |
| | | | *Note:* For the following procedures, remove the system from service in accordance with 4.01 through 4.03. |
| | | | B. Isolate trouble to near end or far end as follows:<br>Connect a 1013A handset, with switch in monitor position, to TS C, terminals 17 and 18. Guard tone (2430 Hz) should be heard. |
| | | | *CAUTION: Do not hold handset against ear for the following test.* |
| | | | C. If HF OK lamp failed to light, operate and release TEST switch on transmitter control panel. Listen for 70-ms burst of enhanced HF trip tone, followed by a 130-ms burst of low-level HF trip hold tone, followed by guard tone. |
| | | | *Note:* During period the trip tone burst is present, guard tone and HF supervisory tone (1595 Hz) are also present. |
| | | | D. If only TEST OK lamp failed to light in previous test (C), operate and release TEST switch and listen for HF tone burst, followed shortly by a 70-ms burst of enhanced low-frequency trip tone, followed by 130 ms of low-frequency trip tone, followed by guard tone. |
| | | | E. If in C or D above, tones are received properly, trouble in local main or supervisory receiver, or supervisory transmitter is indicated. |

TROUBLESHOOTING CHART

| STEP | CONTROL OR INDICATOR | NORMAL CONDITION | PROBABLE CAUSE AND/OR CORRECTIVE ACTION |
|---|---|---|---|
| 6 (Cont) | | | F. Try replacing CPs one at a time, in the following order:<br>CP-2 (BA)<br>CP-4 (CB) (If HF OK failed)<br>CP-5 (CC) (If TEST OK only failed)<br>CP-6 (DA)<br>CP-3 (CA)<br>Verify test after each individual CP has been replaced to see if trouble has been cleared.<br><br>G. If tone bursts *are not* received properly on line, verify that tones are being transmitted by the local transmitter. Monitor the transmitting line. Connect the 1013A handset to TS F, terminals 17 and 18. Guard tone should be heard.<br><br>*CAUTION: Do not hold handset against ear for the following test.*<br><br>H. Operate and release TEST switch on transmitter. Listen for 70-ms burst of enhanced HF trip tone, followed by a 130-ms burst of low-level HF trip hold tone, followed shortly by a 70-ms burst of enhanced LF trip tone, followed by a 130-ms burst of low-level LF trip tone, followed by guard tone.<br><br>*Note:* During period the trip tone bursts are present, guard tone and HF supervisory tone (1595 Hz) are also present.<br><br>I. If the above tones *are not* being transmitted properly, trouble in local main or supervisory transmitter is indicated.<br><br>J. Try replacing CPs one at a time, in the following order:<br>CP-1 (AA)<br>CP-2 (BA).<br><br>Verify test after each CP has been replaced to see if trouble has been cleared.<br><br>K. If above tones *are* being transmitted properly, trouble in the distant receiver or transmitter is indicated. |

TROUBLESHOOTING CHART

| STEP | CONTROL OR INDICATOR | NORMAL CONDITION | PROBABLE CAUSE AND/OR CORRECTIVE ACTION |
|---|---|---|---|
| 6 (Cont) | | | L. Perform out-of-service trip test from local site to remote site by carrying out test Steps 8 through 16. If test fails, trouble in remote main receiver is indicated. If initial test indicated HF OK test failure, try replacing CP-4 (CB) in the remote receiver. If initial test indicated failure of TEST OK only, try replacing CP-5 (CC) in the remote receiver. If the out-of-service test is successful, trouble in the remote main transmitter, supervisory receiver, or supervisory transmitter is indicated. Perform out-of-service trip test from remote site to local site. If test fails, trouble in remote main transmitter is indicated. Try replacing CP-1 (AA). If test is successful, try replacing CP-6 (DA), followed by CP-2 (BA) in remote receiver. Verify test after each CP has been replaced to see if trouble has been cleared.<br><br>TWO-POINT UNIDIRECTIONAL SYSTEM<br><br>*Note:* For the following procedures, remove the system from service in accordance with 4.01 through 4.03.<br><br>M. Isolate trouble to near or far end as follows: At transmit end, connect a 1013A handset, with switch in monitor position, to TS C, terminals 17 and 18. Guard tone (2430 Hz) should be heard.<br><br>N. Operate and release TEST switch on transmitter control panel. Listen for 200-ms periods when supervisory tone is shifted from 1520 Hz to 1595 Hz instead of HF and LF trip tones heard in a bidirectional system as described in C.<br><br>*Note:* Since guard tone is continuously present, the low-level supervisory tone shift will be relatively difficult to detect<br><br>O. If tones described in N above ***are*** present, trouble in local supervisory receiver or transmitter is indicated. |

TROUBLESHOOTING CHART

| STEP | CONTROL OR INDICATOR | NORMAL CONDITION | PROBABLE CAUSE AND/OR CORRECTIVE ACTION |
|---|---|---|---|
| 6 (Cont) | | | P. Try replacing CP-2 (BA) followed by CP-6 (DA). Verify test after each CP has been replaced to see if trouble has been cleared.<br><br>Q. If tones described in N above *are not* present, verify that tones are being transmitted properly by monitoring transmit line. Connect 1013A handset to TS F, terminals 17 and 18. Guard tone should be heard.<br><br>*CAUTION: Do not hold handset against ear for the following test.*<br><br>R. Operate and release TEST switch on transmitter control panel. Listen for 70-ms burst of enhanced HF trip tone, followed by a 130-ms burst of low-level HF trip tone, followed shortly by a 70-ms burst of enhanced LF trip tone, followed by a 130-ms burst of LF trip tone, followed by guard tone.<br><br>*Note:* During the period trip tone burst is present, guard tone and supervisory tone are also present.<br><br>S. If tones *are not* being transmitted properly, trouble in local main or supervisory transmitter is indicated.<br><br>T. Try replacing CPs one at a time in the following order:<br>CP-1 (AA)<br>CP-2 (BA).<br>Verify test after each CP has been replaced to see if trouble has been cleared.<br><br>U. If tones *are* being transmitted properly, trouble in the distant receiver or supervisory transmitter is indicated.<br><br>V. At distant receiver, try replacing CPs in the following order:<br>CP-2 (BA)<br>CP-4 (CB) (If HF OK failed)<br>CP-5 (CC) (If TEST OK only failed)<br>CP-6 (DA)<br>CP-3 (CA) |

TROUBLESHOOTING CHART

| STEP | CONTROL OR INDICATOR | NORMAL CONDITION | PROBABLE CAUSE AND/OR CORRECTIVE ACTION |
|---|---|---|---|
| 6 (Cont) | | | Verify test after each CP has been replaced to see if trouble has been cleared. |
| | | | MULTIPOINT UNIDIRECTIONAL SYSTEM |
| | | | *Note:* For the following procedures, remove the system from service in accordance with 4.01 through 4.03. |
| | | | W. Isolate trouble to the transmit end or a particular receive end as follows: At transmit end, connect a 1013A handset, with switch in monitor position, to TS C, terminals 17 and 18 of receiver No. 1. Guard tone (2430 Hz) should be heard. |
| | | | X. Operate and release TEST switch on transmitter. Listen for 200-ms periods when supervisory tone is shifted from 1520 Hz to 1595 Hz instead of HF and LF trip tones heard in bidirectional system as described in C. |
| | | | *Note:* Since guard tone is continuously present, the low-level supervisory tone shift will be relatively difficult to detect. |
| | | | Y. Repeat Steps 6W and X for all other supervisory receivers. If tones described in Step 6X ***are not*** received on a particular line, trouble in that associated distant terminal is indicated. |
| | | | Z. At distant receive terminal where trouble was indicated, try replacing CPs one at a time in the following order:<br>CP-2 (BA)<br>CP-4 (CB) (If HF OK failed)<br>CP-5 (CC) (If TEST OK only failed)<br>CP-6 (DA)<br>CP-3 (CA)<br>Verify test from transmitting end after each CP has been replaced to see if trouble has been cleared. |

| STEP | CONTROL OR INDICATOR | NORMAL CONDITION | PROBABLE CAUSE AND/OR CORRECTIVE ACTION |
|---|---|---|---|
| 6 (Cont) | | | ZA. If tones described in X *are not* present on any receive line, verify that proper tones are being transmitted. With switch in monitoring position, connect 1013A handset to TS F, terminals 17 and 18. Guard tone should be heard.<br><br>*CAUTION: Do not hold handset against ear for the following test.*<br><br>ZB. Operate and release TEST switch on transmitter. Listen for 70-ms burst of enhanced HF trip tone, followed by a 130-ms burst of low-level HF trip tone, followed by a 130-ms burst of low-level HF trip hold tone, followed shortly by a 70-ms burst of enhanced LF trip tone, followed by a 130-ms burst of low-level LF trip hold tone, followed by guard tone.<br><br>*Note:* During period the trip tone burst is present, guard tone and HF supervisory tone (1595 Hz) are also present.<br><br>ZC. If above tones *are not* being transmitted properly, trouble in the local main or supervisory transmitter is indicated.<br><br>ZD. Try replacing CPs one at a time in the following order:<br>CP-1 (AA)<br>CP-2 (BA)<br>Verify test after each CP has been replaced to see if trouble has been cleared.<br><br>ZE. If proper tone shifts *are* present on all receive lines (Step 6X), try replacing local supervisory transmitter CP-2 (BA). Repeat test to see if trouble is cleared.<br><br>ZF. If Step 6ZE *did not* clear trouble, a defect in one of the supervisory receivers is indicated. Select 30-Vdc scale on VOM and connect negative lead to TS C, terminal 4. On receiver to be tested, disconnect lead from TS B, terminal 1, and connect positive lead of VOM to terminal 1. Operate and release TEST switch on transmitter and observe two positive pulses on VOM after TEST switch is |

TROUBLESHOOTING CHART

| STEP | CONTROL OR INDICATOR | NORMAL CONDITION | PROBABLE CAUSE AND/OR CORRECTIVE ACTION |
|---|---|---|---|
| 6 (Cont) | | | released. If pulses are observed, disconnect VOM, replace lead on TS B, terminal 1, and repeat test on next receiver. Absence of of the pulse on a receiver indicates a defective receiver. Try replacing CP-6 (DA) in suspect receiver and repeat VOM test to verify that trouble is cleared.<br><br>MULTIPOINT SYMMETRICAL SYSTEM<br><br>*Note 1:* For the following procedures, remove the system from service in accordance with 4.01 through 4.03.<br><br>*Note 2:* In-service trip tests of a multipoint symmetrical system may be performed at any site. In the following procedures, the site at which the test is performed is referred to as the local site and all other sites are referred to as remote sites.<br><br>ZG. Isolation of trouble in the multipoint symmetrical system may be initiated at any site in the system. Isolate trouble to local site or a remote site as follows: Connect a 1013A handset, with switch in monitor position, to TS C, terminals 17 and 18 of receiver No. 1. Guard tone should be heard.<br><br>*CAUTION: Do not hold handset against ear for the following test.*<br><br>ZH. Operate and release TEST switch on transmitter. Listen for 70-ms burst of enhanced HF trip tone, followed by a 130-ms burst of low-level HF trip hold tone, followed by a 200-ms shift of the supervisory signal from 1520 Hz to 1595 Hz. This is followed by a 70-ms burst of enhanced LF trip hold tone, followed by a 130-ms burst of low-level LF trip hold tone, followed by a 200-ms shift of the supervisory signal from 1520 Hz to 1595 Hz, followed by guard tone. |

TROUBLESHOOTING CHART

| STEP | CONTROL OR INDICATOR | NORMAL CONDITION | PROBABLE CAUSE AND/OR CORRECTIVE ACTION |
|---|---|---|---|
| 6 (Cont) | | | *Note:* Since guard tone is continuously present, the low-level supervisory tone shift will be relatively difficult to detect.<br><br>ZI. Repeat Steps 6ZG and ZH for remaining receivers. Absence of trip tone burst or supervisory tone shift on the line indicates trouble at that associated distant terminal.<br><br>ZJ. If trip tone bursts are absent on all receive lines, verify that proper tone bursts are being transmitted by monitoring the transmitting line. Connect 1013 handset to TS F, terminals 17 and 18. Guard tone should be heard.<br><br>*CAUTION: Do not hold handset against ear for the following test.*<br><br>ZK. Operate and release TEST switch on transmitter. Listen for a 70-ms burst of enhanced HF trip tone, followed by a 130-ms burst of low-level HF trip hold tone, followed shortly by a 70-ms burst of enhanced LF trip tone, followed by a 130-ms burst of low-level LF trip hold tone, followed by guard tone.<br><br>*Note:* During period the trip tone burst is present, guard tone and HF supervisory tone (1595 Hz) are also present.<br><br>ZL. If above tones *are not* being transmitted properly, trouble in local main or supervisory transmitter is indicated. Try replacing CPs one at a time in the following order:<br><br>CP-1 (AA)<br>CP-2 (BA).<br>Verify test after each CP has been replaced to see if trouble has been cleared.<br><br>ZM. If proper tone bursts and shifts *are* present on all receive lines (Steps 6ZG and ZH), try replacing CPs in the following order:<br><br>CP-7 (EA)<br>CP-2 (BA). |

TROUBLESHOOTING CHART

| STEP | CONTROL OR INDICATOR | NORMAL CONDITION | PROBABLE CAUSE AND/OR CORRECTIVE ACTION |
|---|---|---|---|
| 6 (Cont) | | | Verify test after each CP has been replaced to see if trouble has been cleared. If this *does not* clear trouble, it is an indication of trouble in one of the receivers.<br><br>ZN. Isolate defective receiver as follows: Select the 30-Vdc scale on VOM. Connect negative lead to TS C, terminal 4. Connect positive lead to TS B, terminal 9. Operate TEST switch on transmitter and observe VOM for one or two short pulses as follows:<br><br>Initial Test Failure — No. of Pulses<br>HF OK — 1<br>TEST OK only — 2<br><br>Repeat this test for all receivers. Absence of pulse(s) indicates a defective supervisory receiver. Try replacing CP-6 (DA) in suspect receiver. Verify test after CP has been replaced to see if trouble has been cleared.<br><br>ZO. If proper pulses are received on TS B, terminal 9 for all receivers, and initial test indicated failure of HF OK test, connect VOM positive lead to TS B, terminal 6 and repeat procedure in Step 6ZN, looking for one pulse.<br><br>ZP. If proper pulses are received on TS B, terminal 9 for all receivers, and initial test indicated failure of TEST OK, connect VOM positive lead to TS B, terminal 7 and repeat procedure in Step 6ZN, looking for one pulse.<br><br>ZQ. Absence of a pulse in Step ZO or ZP indicates a defective main or supervisory receiver.<br><br>ZR. Have attendant at associated distant site transmit an in-service trip test signal (Steps 8 through 16). If test from distant end is unsuccessful, trouble in local main receiver is indicated. If test is successful, trouble in local supervisory receiver is indicated. |

TROUBLESHOOTING CHART

| STEP | CONTROL OR INDICATOR | NORMAL CONDITION | PROBABLE CAUSE AND/OR CORRECTIVE ACTION |
|---|---|---|---|
| 6 (Cont) | | | ZS. If trouble in main receiver is indicated and if initial test indicated HF OK failure, try replacing CP-4 (CB). If initial test indicated TEST OK failure, try replacing CP-5 (CC). If trouble in supervisory receiver is indicated, try replacing CP-6 (DA). Verify test after each CP has been replaced to see if trouble has been cleared.<br><br>ZT. If monitoring test using handset on receiving line indicates trouble at remote site, and if HF *or* LF trip tone burst is absent, trouble is in distant receiver. Perform out-of-service trip test from local site to remote site as described in Steps 8 through 16. If test is unsuccessful, trouble in distant main receiver is indicated. If initial in-service test indicated failure of HF OK test, try replacing CP-4 (CB) at distant receiver. If initial in-service test indicated failure of TEST OK, try replacing CP-5 (CC) at distant receiver. Verify test after each CP has been replaced to see if trouble has been cleared.<br><br>ZU. If out-of-service trip test is successful, trouble in the remote main transmitter, supervisory receiver, or supervisory transmitter is indicated. Try replacing CPs in the following order:<br>CP-2 (BA)<br>CP-6 (DA)<br>CP-1 (AA)<br>Verify test after each CP has been replaced to see if trouble has been cleared.<br><br>ZV. If trip tone burst(s) is present but the following momentary shift of supervisory tone from 1520 Hz to 1595 Hz is absent, failure of one or more links between distant terminal and one or more other distant terminals is indicated. Visit the distant terminal and perform in-service test and localizing procedures at that terminal. |
| 7 | — | — | See Steps 1 and 2. |
| 8 | — | — | — |

TROUBLESHOOTING CHART

| STEP | CONTROL OR INDICATOR | NORMAL CONDITION | PROBABLE CAUSE AND/OR CORRECTIVE ACTION |
|---|---|---|---|
| 9 | — | — | — |
| 10 | — | — | — |
| 11 | — | — | — |
| 12a | TRIP TEST lamp | lighted | A. If TRIP TEST lamp *does not* light but TRIP lamp on receiver is lighted, trouble in receiver trip output module is indicated. Select 300-Vdc scale on VOM and verify station battery voltage on TS M, terminals 1 and 2. (Terminal 1 is positive.)<br>B. Select 30-Vdc scale on VOM and verify +15V supply to module on TS M, terminals 5 and 9. (Terminal 5 is positive.)<br>C. With VOM on 30-Vdc scale, check voltage on TS M, terminals 6 and 9. (Terminal 6 is positive.) With system normal (guard tone being received), terminal 6 (TD lead) should be above +13.5 volts. When a trip signal is transmitted, TD lead should be below +1.5 volts. Absence of +13.5 volts during normal condition indicates trouble in receiver trip output module. Try replacing this module. Verify test after module replacement to see if trouble has been cleared.<br>D. If TRIP lamp lights but voltage on TD lead does not drop below 1.5 volts when a trip signal is transmitted, try replacing circuit pack CP-5 (CC). Verify test after CP has been replaced to see if trouble has been cleared. |
| 12b | TRIP lamp | lighted | E. If neither TRIP TEST nor TRIP lamp lights when a trip signal is transmitted, verify in-service test described in Steps 5 and 6. If in-service test *is not* met, isolate trouble in accordance with troubleshooting Steps 5 and 6. If in-service test *is* met, try replacing CP-5 (CC). Verify test after CP has been replaced to see if trouble has been cleared. |
| 13a | TRIP lamp | lighted | See 5.05 |

TROUBLESHOOTING CHART

| STEP | CONTROL OR INDICATOR | NORMAL CONDITION | PROBABLE CAUSE AND/OR CORRECTIVE ACTION |
|---|---|---|---|
| 13b | AUDIBLE ALARM | operates | See 5.05 |
| 14 | REM TRIP lamp | lighted | If REM TRIP lamp fails to light, try replacing CP-6 (DA) at transmit site. If this does not clear trouble, try replacing CP-2 (BA) at receive site. If this does not clear trouble, try replacing receiver control panel. Verify test after each CP has been replaced to see if trouble has been cleared. |
| 15 | TRIP lamp | extinguished | If TRIP lamp fails to extinguish, try replacing CP-5 (CC). If this does not clear trouble, try replacing receiver control panel. |
| 16 | REM TRIP lamp | extinguished | See Step 15. |
| 17 thru 19 | — | — | — |
| 20 thru 22 | TRIP lamp "A"<br>TRIP lamp "B"<br>TRIP TEST lamp | lighted<br>lighted<br>lighted | A. If TRIP TEST lamp lights on Step 20 but not on Step 21, verify connection from receiver "B" TS A, terminal 9, to receiver "A" TS A, terminal 11. If connection is in place, try replacing CP-5 (CC) in receiver "B", followed by replacing CP-5 (CC) in receiver "A". If replacing CPs does not clear trouble, try replacing receiver "A" control panel (J1G030A, L4).<br><br>B. If TRIP TEST lamp lights on Step 21 but not on Step 20, try replacing CP-5 (CC) in receiver "A". If replacing CP does not clear trouble, try replacing receiver "A" control panel (J1G030A, L4).<br><br>C. If TRIP lamps on both "A" and "B" receivers light on Steps 20, 21, and 22 but the TRIP TEST lamp does not light on any step, trouble in the trip output module is indicated. Verify by performing trouble locating procedure in 12a—A through C.<br><br>D. If TRIP lamp fails to light on either receiver when trip is transmitted on the channel, perform troubleshooting Step 12E. |

TROUBLESHOOTING CHART

| STEP | CONTROL OR INDICATOR | NORMAL CONDITION | PROBABLE CAUSE AND/OR CORRECTIVE ACTION |
|---|---|---|---|
| 23 thru 27 | — | — | — |
| 28 thru 39 | TRIP lamp "A"<br>TRIP TEST lamp | lighted<br>extinguished | A. When channel "A" is tested alone, if TRIP TEST lamp lights without channel "B" being disabled, using VOM on 30-Vdc scale, measure voltage on TS A, terminal 10 of receiver "A". (TS A, terminal 10, is positive; TS C, terminal 3, is ground.) If VOM indicates below 1.5 volts, a defective CP-5 (CC) in receiver "B" is indicated. Replace CP and repeat test to see if trouble is cleared. |
| | TRIP lamp "A"<br>TRIP TEST lamp | lighted<br>lighted | B. If VOM indicates above 13.5 volts, a defective CP-5 (CC) in receiver "A" is indicated, or possibly a defective "A" receiver control panel. Replace CP and repeat test to see if trouble is cleared: |
| | TRIP lamp "B"<br>TRIP TEST lamp | lighted<br>extinguished | C. If TRIP lamp lights while TRIP TEST lamp *does not* light when channel "B" is disabled while testing channel "A", but the same test applied to channel "B" is successful, using VOM on 30-Vdc scale measure voltage on TS A, terminal 10 on receiver "A" while testing channel "A". (TS A, terminal 10, is positive; TS C, terminal 3, is ground.) If VOM indicates below 1.5 volts, a defective CP-5 (CC) in receiver "B" is indicated. Replace CP and repeat test to see if trouble is cleared. |
| | TRIP lamp "B"<br>TRIP TEST lamp | lighted<br>lighted | D. If VOM indicates above 13.5 volts, a defective CP-5 (CC) in receiver "A" is indicated. Replace CP and repeat test to see if trouble is cleared. |
| | | | E. When channel "B" is tested alone, if TRIP TEST lamp lights without disabling channel "A", a defective CP-5 (CC) in receiver "A" is indicated. Replace CP and repeat test to see if trouble is cleared. |
| | | | F. If TRIP lamp on receiver "B" lights while the TRIP TEST lamp *does not* light when channel "A" is disabled while testing channel "B", but the same test applied to channel "A" is successful, using VOM on |

TROUBLESHOOTING CHART

| STEP | CONTROL OR INDICATOR | NORMAL CONDITION | PROBABLE CAUSE AND/OR CORRECTIVE ACTION |
|---|---|---|---|
| 28 thru 39 (Cont) | | | 30-Vdc scale, measure voltage on TS A, terminal 11 of receiver "A" while testing channel "B". (TS A, terminal 11 is positive; TS C, terminal 3, is ground). If VOM indicates below 1.5 volts, CP-5 (CC) in receiver "A" is probably defective. Replace CP and repeat test to see if trouble is cleared. |
| | | | G. If VOM indicates above 13.5 volts, a defective CP-5 (CC) in receiver "B" is indicated. Replace CP and repeat test to see if trouble is cleared. |
| | | | H. If in Steps 28 through 39, A through G, TRIP lamp does not light as required, verify in-service test described in Steps 5 and 6. If in-service test *is not* met, isolate trouble in accordance with troubleshooting Steps 5 and 6. If in-service test *is* met, try replacing CP-5 (CC). Verify test after CP has been replaced to see if trouble has been cleared. |
| | | | I. If TRIP lamps on both receivers light properly on all tests, but TRIP TEST lamp fails to light on any test, perform troubleshooting Steps 12A through D to determine if trouble is in receiver "A" or in the receiver trip output module. |
| | | | J. If individual tests of both channels are met but TRIP TEST lamp does not light during dual-channel test, a defective CP-5 (CC) in receiver "A" is indicated. Replace CP and repeat test to see if trouble is cleared. |
| | | | K. If in Steps A through J replacing designated CP does not clear trouble, try replacing receiver "A" control panel (J1G030A, L4). |
| 40 | TRIP lamps | extinguished | If TRIP lamp fails to extinguish, try replacing CP-5 (CC). If this does not clear trouble, try replacing receiver control ap panel (J1G030A, L4). |

TROUBLESHOOTING CHART

| STEP | CONTROL OR INDICATOR | NORMAL CONDITION | PROBABLE CAUSE AND/OR CORRECTIVE ACTION |
|---|---|---|---|
| 41 thru 44 | — | — | — |
| 45 | TRIP lamp | lighted | See next step. |
| 46 | TRIP lamp | remains lighted | A. TRIP lamp failing to light may be indication of distant transmitter failing to transmit trip hold signal. This would be indicated by SIG FAIL lamp lighting at distant transmitter. Replace CP-1 (AA) at distant transmitter. Repeat test to see if trouble is cleared.<br>B. If there is no SIG FAIL alarm at distant transmitter, verify level of received signal. Select —10 dB scale on VOM. Connect VOM to TS C, terminals 17 and 18. Compare received level of trip hold signal with received level of guard signal. The difference in levels should not exceed 1 dB. If proper trip hold signal is received, trouble in receiver is indicated. Try replacing the following CPs one at a time, in the following order:<br>CP-5 (CC)<br>CP-4 (CB).<br>Verify test after each CP has been replaced to see if trouble has been cleared. |
| 47 | TRIP lamp | extinguished | See next step. |
| 48 | TRIP lamp | lighted | If TRIP lamp ***does not*** extinguish and relight when line is opened and closed, replace CP-5 (CC). Verify test after CP has been replaced to see if trouble has been cleared. |
| 49 | — | — | — |
| 50 | — | — | — |
| 51 | — | — | — |
| 52 thru 81 | — | — | See 5.05 |

TROUBLESHOOTING CHART

| STEP | CONTROL OR INDICATOR | NORMAL CONDITION | PROBABLE CAUSE AND/OR CORRECTIVE ACTION |
|---|---|---|---|
| 82 | SP lamp | flashes | Failure of lamp to flash, or a steady light, indicates defective keying input module. Replace module. Repeat test to see if trouble has been cleared. |
| 83 thru 90 | — | — | |
| 91 | VOM | indicates station battery | Failure of this test indicates wiring trouble, keying input module ON LINE — TEST switch trouble, or receiver trip output NORMAL — TEST switch trouble. Leave NORMAL — TEST switch on NORMAL. Operate ON LINE — TEST switch at transmit terminal to TEST A (for single-channel system) or TEST A + B (for dual-channel system). Operate TRIP TEST switch on keying input module. If VOM at receiver now indicates station battery voltage, trouble in keying input module is indicated. If VOM does not indicate station battery voltage, trouble in trip output module is indicated. Replace appropriate module and repeat test to see if trouble is cleared. |
| 92 thru 94 | — | — | See Step 91. |
| 95 | — | — | — |


Fig. 1 – Additional Connections at Transmitter for End-to-End Test

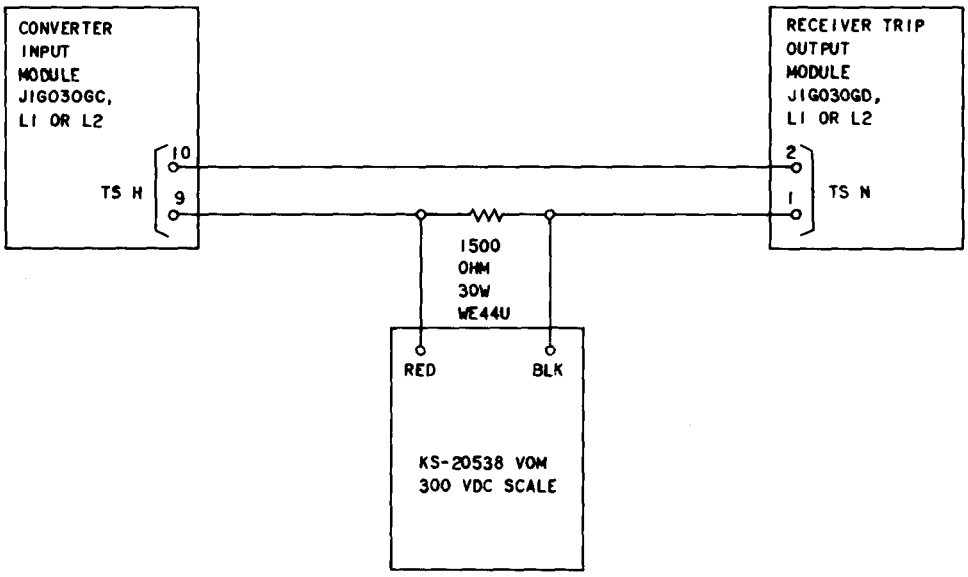


Fig. 2 – Additional Connections at Receiver for End-to-End Test