

NO. 3 ESS  
 CONTINUITY TESTS

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1. GENERAL INFORMATION

1.1 Description

1.11 This section provides general information pertaining to continuity testing installer-run cable for the No. 3 Electronic Switching System.

1.12 Continuity testing consists of verifying the correct termination of both ends of installer-run cable on a circuit to circuit basis and that a conductive path between these terminating points does indeed exist.

1.13 Since almost all installer-run cable is connectorized using Berg type connectors and because of heavy cable concentration, access to the lead terminations, wherever possible, will be gained by using a terminal extender board at the front of the frames.

1.14 Sections 101 through 106 of Handbook 269 contain cable termination information for each No. 3 ESS frame (except the Processor and Maintenance Frames) from which cables originate. Processor and Maintenance Frame interframe connections are coax cable and will be checked using Test Programs. The Reference Chart on page 5 provides a cross reference of frames and section numbers.

1.2 Purpose of Test

1.21 The purpose of these tests is to insure correct interconnection of circuits before power is applied to them, thereby avoiding possible damage to circuit components and insuring proper execution of subsequent circuit tests.

1.3 Sequence

1.31 Sequence information is contained in each individual continuity test section.

1.32 It is recommended that these continuity tests be performed before Power Verification tests.

1.4 Reference Information

1.41 The terminations shown for cable leads in these sections were obtained from circuit schematic drawings, typical equipment layout drawings, and typical job wiring lists. For each job, the particular wiring lists should be referenced to determine cable terminations.

1.42 In the continuity test sections, no special identification is made of leads that are normally grounded or connected through key or relay contacts. However, if experience indicates that such identification is required, the appropriate identification information will be added as needed.

1.5 Records

1.51 Test record information appears in each individual continuity test section.

2. TEST EQUIPMENT

2.1 Test Set Requirements

2.11 The following test sets should be available to perform continuity tests:

<u>ITE</u>	<u>Description</u>	<u>With ITE</u>
4525A	Tone Buzzer Test Set	*5653
4511	Whistler Test Set	*5653
5477B	Extender Board	*5653

3.2 Cords

3.21 The following cord is to be used to extend the test prod leads of ITE-4525A if necessary:

<u>ITE</u>	<u>Description</u>	<u>With ITE</u>
9424	Cord, 6' long with ITE-2461 sockets on both ends.	*5653

### 3.3 Accessories

3.31 The following accessory is to be used in conjunction with ITE-9424 cord:

Code No.	Description	With ITE
141	Cord Tip	*5653

\* No. 3 ESS Test Accessory Set.

### 3. TEST PREPARATION

3.1 Test preparation for continuity tests consists of locating and calibrating test equipment and general familiarization of test set operation.

#### 4. ITE-4525A TONE BUZZER TEST SET

##### 4.1 Description

4.11 The ITE-4525A set consists of a battery powered transistorized oscillator and amplifier circuit housed in a plastic case. Physical dimensions are approximately 6 x 4 x 2 inches.

4.12 The oscillator circuit contains a modified Wien bridge for controlling frequency of oscillation which is approximately 800 Hz. Transient voltages developed across the test prods are less than 0.3V peak. Short circuit current is less than 0.5 MA at frequency of oscillation.

4.13 The output of the oscillator is amplified through a self-contained amplifier circuit and is made audible through a small speaker.

4.14 The Tone Buzzer Test Set provides a general use continuity test set that is safe to use with circuitry containing solid-state devices in testing Electronic Switching Systems.

##### 4.2 Calibration

4.21 Turn the ITE-4525A Tone Buzzer Test Set switch to "ON" position. Connect pin end of test cords into jacks "A" and "B" on test set. Using a narrow blade screwdriver turn "SENS" potentiometer to the extreme COUNTER-CLOCKWISE position. Insert test prods into "20W" jacks and slowly turn "SENS" potentiometer CLOCKWISE until audible tone is heard. Then turn slightly counterclockwise until tone is barely audible. If no tone is heard, check batteries in set.

4.22 Remove test prods from "20W" jacks and touch prods together. A louder tone should be heard at a slightly lower frequency. This adjustment will check continuity up to 20 ohms on the lead under test and will not yield a tone for any resistance over 20 ohms.

### 4.3 Operation

4.31 Locate the ITE-4525A test set at a convenient point between the frames containing the leads under test. If the test prod leads are too short, extend one lead with an ITE-9424 cord.

NOTE: To accomplish this, insert the test set prod lead into one of the ITE-2461 sockets on one end of the ITE-9424 cord and insert the 141 cord tip into the ITE-2461 socket on the other end of the cord.

4.32 If it is necessary to extend the test prods even more, the spare jack wiring between frames may be used, provided it has already been continuity tested.

4.33 Touch one test prod of ITE-4525A to one end of the lead to be tested and the other test prod to the other end of the lead to be tested. Observe that the tone buzzer operates.

4.34 If the tone buzzer does not operate or the tone observed is not clear, there is a possibility of an open, short, or cross in the lead tested. The ITE-4511 Whistler Test Set may be used to determine which fault exists.

#### 5. ITE-4511 WHISTLER TEST SET

##### 5.1 Description

5.11 ITE-4511 Whistler Test Set was developed to provide a readily portable set capable of detecting crosses in cabling and wiring that is not connected to either battery or ground. However, it may also be used as a continuity test set.

5.12 The set consists of a plastic probe, grounding cord - clip and an operator's headset receiver. The probe houses the ITE-4511 circuit and also provides the means of connecting to the circuit under test.

5.13 The ITE-4511 Whistler circuit is a two-transistor oscillator circuit shown schematically in Figure 1. The oscillator feedback circuit is open and terminates in the probe pick and the grounding cord. A capacitance connected between the probe pick and the grounding cord completes the oscillator feedback circuit and causes the circuit to oscillate. An audible tone is then heard in the test set receiver. Frequency of oscillation is dependent upon the value of capacitance connected between the probe pick and the grounding cord. When used as a Whistler Test Set, the grounding cord is connected to central office ground. Then, when the probe pick is connected to a conductor to be tested for crosses, the set oscillates at a frequency determined by the conductor's capacitance to ground.

5.14 ITE-4511 may also be used as a test headset with the added provision of a 10,000 ohm resistor in series with the receiver. The 10,000 ohm resistor is a safety feature provided for use when testing circuits that might be damaged by the relatively heavy currents that can flow through the conventional 300 ohm test receiver. The 10,000 ohm resistor may be shunted out, when desired, by operating a nonlocking switch on the probe.

5.15 The Whistler Circuit is powered by a miniature 4-cell dry battery. Current consumption is on the order of 200-300 microamperes. With this low current drain, batteries should last for several months of normal usage of the Whistler.

## 5.2 Calibration

5.21 Operate slide switch to W position.

5.22 With the probe held so that the probe pick points away from the operator, rotate the knurled disk projecting through the probe case away from the OFF mark engraved on the case (counterclockwise rotation). This operation closes a switch in the Whistler battery supply.

5.23 Touch the grounding cord clip to the test set probe. A low pitched buzz should be heard in the test set receiver. As the knurled control disk is rotated further in a counterclockwise direction, the intensity and, to some extent, the frequency of the tone in the receiver will increase.

5.24 Connect the grounding cord clip to a frame ground near the termination of the conductors to be tested for crosses.

5.25 Touch the probe pick to one of the conductors under test. Adjust the knurled disk, if necessary, to obtain a whistle of suitable pitch. With conductors of short length it may be necessary to rotate the disk almost fully counterclockwise.

## 5.3 Whistler Operation

NOTE: The ITE-4511 will not perform satisfactorily on cable conductor less than five feet in length. Also, it is not recommended for cross tests in local forms where different wires have different lengths, as the pitch of the whistle is different for different lengths of wire.

5.31 Touch the probe to each of the conductors under test. Each should produce a whistle of the same pitch and volume. (The grounding cord clip should be connected to frame ground.)

5.32 Any fault in the conductor under test will cause a whistle of different pitch than that produced by troublefree conductors.

5.321 A cross with battery or ground, directly or through apparatus, will produce a low pitched whistle or buzz of about the same pitch as if the test probe were connected to ground directly.

5.322 A cross with any other conductor in the same cable will lower the pitch of the whistle by about one-half an octave.

5.323 A cross with a conductor outside of the cable under test will lower the pitch by an amount that depends on the relative length of the two conductors. If the second conductor is at least half as long as the conductor under test, the change in pitch will be great enough to be readily noticed. If the second conductor is shorter than this, the cross may or may not be detected, depending upon the acuteness of the tester but when the second conductor is tested later, the change caused by being crossed with a longer conductor will be readily detected.

5.324 An open in a conductor will cause it to have less capacity to ground than the troublefree conductors so it will produce a higher pitched whistle than the others. This is not recommended, however, as a test for continuity.

5.33 From the foregoing it can be seen that the Whistler will detect crosses in any cable where there are enough troublefree conductors to establish a normal pitch for the whistle. It is not necessary to strap conductors to ground to detect crosses.

5.34 When the Whistler test has disclosed crossed conductors in a cable, the Whistler may be used to determine which is crossed with which.

5.341 A cross between two conductors can be proved as follows: Both of the suspected conductors will "whistle" at the same pitch. Actually cross the two conductors either with the probe pick or a piece of wire at the test location. There should be no change in the pitch of the whistle if a cross exists between the conductors at some other point.

5.342 A cross between two or more conductors can be proved as follows: Connect the Whistler to one crossed conductor. Touch a grounded test probe to each of the other conductors that showed a cross. The one that produces a tone of about the same pitch as if the Whistler probe were directly grounded is crossed with the conductor connected to the test set.

## 5.4 Test Headset Operation

5.41 While the Whistler test can determine that a conductor is crossed with battery or ground, it cannot determine which one of the conditions it is crossed with. Once it is determined that such a cross exists, the Whistler may be switched to test headset operation and a test for battery or ground can then be made. The following paragraphs describe the use of ITE-4511 as a test headset.

5.42 Operate the slide switch to REC position. This operation partially opens the battery supply to the Whistler circuit and connects the test receiver to the grounding cord and probe tip. A 10,000 ohm resistor is also connected in series with the receiver and probe tip.

NOTE: If the set is used as a test headset for only short intervals between Whistler operations, the Whistler battery circuit need not be opened by rotating the knurled disk to OFF. If the set is used mainly as a test headset for long periods of time or when the set is not in use, the knurled disk should be rotated to OFF. (Fully clockwise - until the battery switch is felt to operate.)

5.43 With the grounding clip cord connected to frame ground, touch the probe pick to the conductor suspected of being crossed with battery or ground. If a click is heard in the headset receiver, the conductor is crossed with battery; if not, it is crossed with ground.

5.44 The 10,000 ohm resistor in series with the receiver and probe can be shunted out by holding the LR switch operated. With the 10,000 ohm resistor shunted out the receiver resistance becomes approximately 300 ohms. (Receiver resistance of 70 ohms plus two 430 ohm resistors connected in parallel.)

5.45 With the LR switch nonoperated, current through the receiver is limited to approximately five milliamperes (assuming a 48-volt battery supply). Currents of this order should not damage equipment, such as dry reed relay contacts.

## 5.5 Maintenance

5.51 Field maintenance of ITE-4511 should ordinarily be limited to replacement of the test set battery.

5.52 If the set becomes inoperative and after replacing the battery it still does not operate correctly, inspect for broken wires and reconnect if possible. Otherwise, return the set to Installation Stockkeeping for repair. Do not attempt to replace any of the test set components in the field other than the battery.

### 5.53 Replacing the Battery (See Figure 3)

5.531 Back off the two round head machine screws located in the end of the probe opposite from the probe tip. The screws need not be removed entirely (back off six or seven turns). Holding the probe in one hand, pull the probe cap back against the loosened screws, the two halves of the probe case can then be removed from their retaining groove in the probe tip assembly. The battery can then be removed from the battery clip.

5.532 The battery is a Mallory 9F type obtainable from Stockkeeping by requisition. The Ray-O-Vac Type 1401 or the Mallory TR-175 type battery may be used as a substitute for the Mallory 9F battery. Before installing the Mallory battery, tear the battery's cardboard container back from the positive (+) end of the battery so that (+) battery clip terminal can make contact with the (+) end of the battery (see Figure 4).

NOTE: If the Mallory TR-175 type is used, adjust the battery holder such that it has a firm grip on both ends of battery.

5.333 Using a Volt-Ohm-Milliammeter, measure the voltage of the new battery. The Mallory 9F and TR-175 type batteries should produce a voltage of at least 7 volts. The Ray-O-Vac 1401 battery should produce a voltage of at least five volts. ITE-4511 may become inoperative as a Whistler if the battery voltage drops below 4 volts.

5.334 Insert the new battery into the battery holder. Be certain the battery is properly poled on installation. The positive end of both the Mallory and Ray-O-Vac batteries is marked and the standard ITE-4511 battery clip positive contact is designated. ITE-4511 sets marked EXP. do not have the battery clip terminals marked for polarity but on all the EXP. sets, the clip contact nearest the probe tip is the positive terminal.

### 5.54 Reassembling the Whistler Case

5.541 Note that the groove in the probe tip assembly and the groove in the probe cap each contain a locating stud and that the top half of the fiber case has a notch in each end.

5.542 The notches in the top cover and locating studs in the probe and cap grooves serve to locate the top half of the case with reference to the controls extending through the top half of the case.

5.543 Install the top and lower halves of the case in the probe tip groove and squeeze the two halves together. Be sure that the receiver cords run along the bottom of the chassis are not pinched between the chassis and the bottom half of the case.

5.544 While holding the two halves of the case together push the end cap down so that the back end of the case enters the cap groove. Tighten the two retaining screws.

6. REFERENCE CHART

FRAME	ABBREV.	J-	SD-	SECTION NUMBER
CONTROL	CONT	3H001C	3H902-01	102
		3H001CJ	3H404-01	106
		3H001BE	3H220-01	106
		3H001BF	3H410-01	106
		3H001CH	3H411-01	106
NETWORK	NET	3H001B	3H901-01	103
		3H001BE	3H220-01	106
		3H001BF	3H410-01	106
MISCELLANEOUS POWER	MP	87824A	82255-01	104
		3H001EC	3H905-01	104
		3H001ED	3H905-01	104
MISCELLANEOUS	M	3H001E	3H903-01	105
		3H001BE	3H220-01	106
		3H001CH	3H411-01	106
		3H001CJ	3H404-01	106
		3H001CK	3H402-01	106
		3H001CL	3H401-01	106
		3H001CM	3H403-01	106
		3H001CN	3H406-01	106
		3H001CP	3H208-01	106
		3H001EE	3H205-01	106
		3H001EF	3H911-01	106

7. FIGURES 1 THROUGH 4

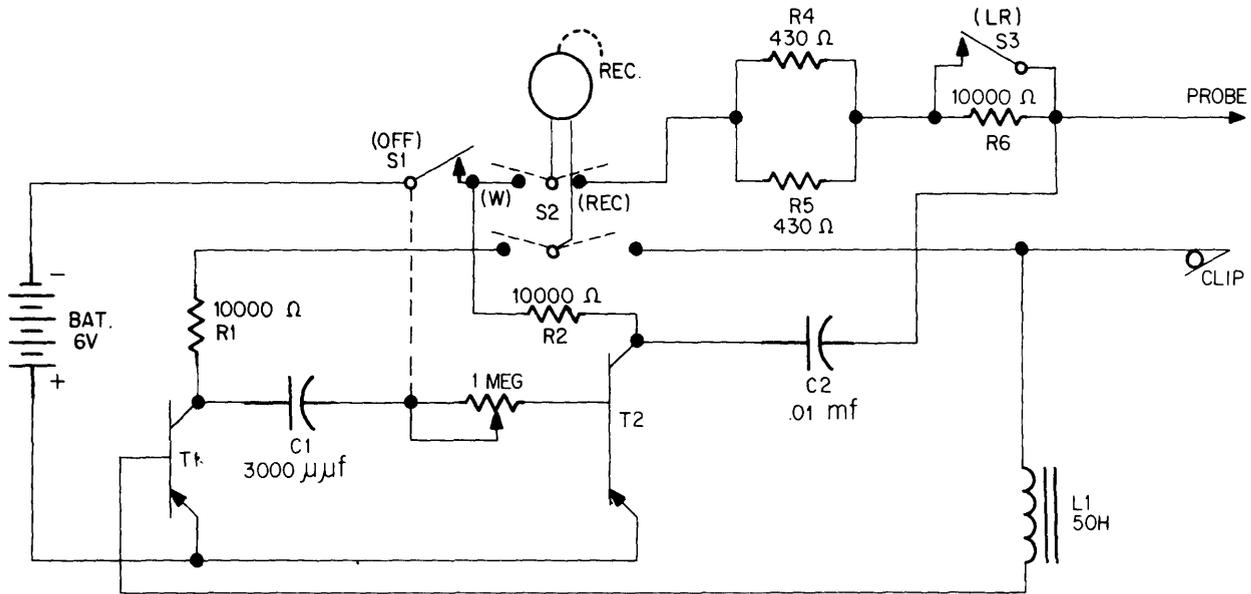


FIGURE 1

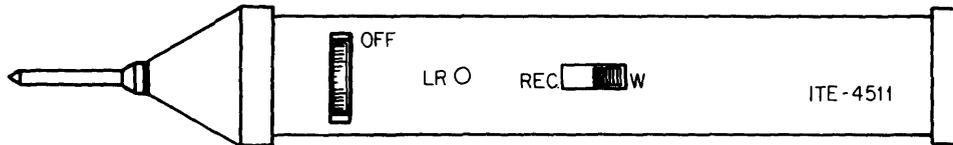


FIGURE 2

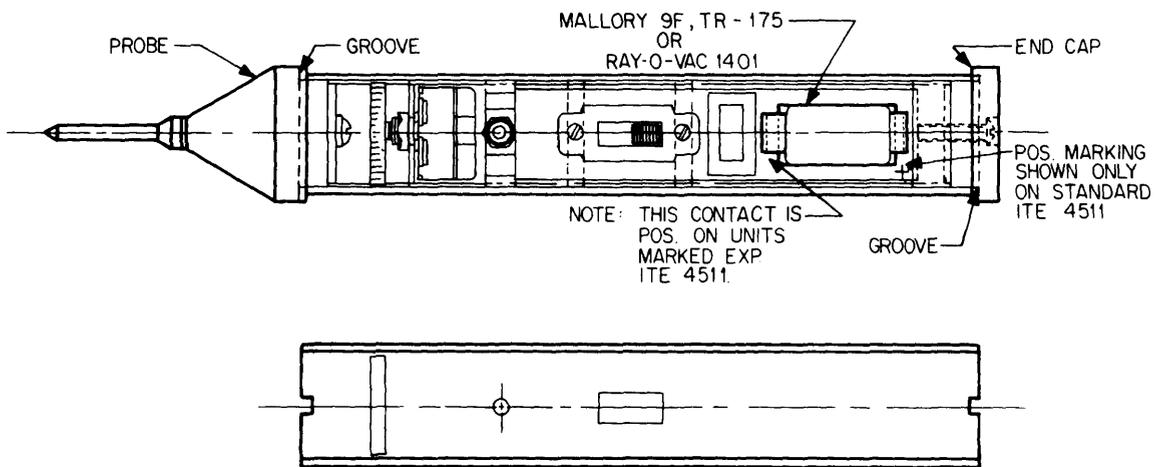


FIGURE 3



FIGURE 4

Manager, ESS Installation & Field Engineering  
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