111A2 RELAY TEST PANEL
FOR POLAR RELAYS
DESCRIPTION AND APPLICATION

1. GENERAL

1.01 This section describes the 111A2 relay test panel which is used for applying the electrical test and readjust requirements to the following types of polar relays: 209FA, 209FB, 209FC, 209FG, 209FH, 209FJ, 215A, 215H, 228A, 255A, and D160118.

1.02 The test circuit is so arranged, that by operating the various keys, the proper conditions are set up for applying the testing and adjusting procedures for a bias test, a sensitivity test and a contact test.

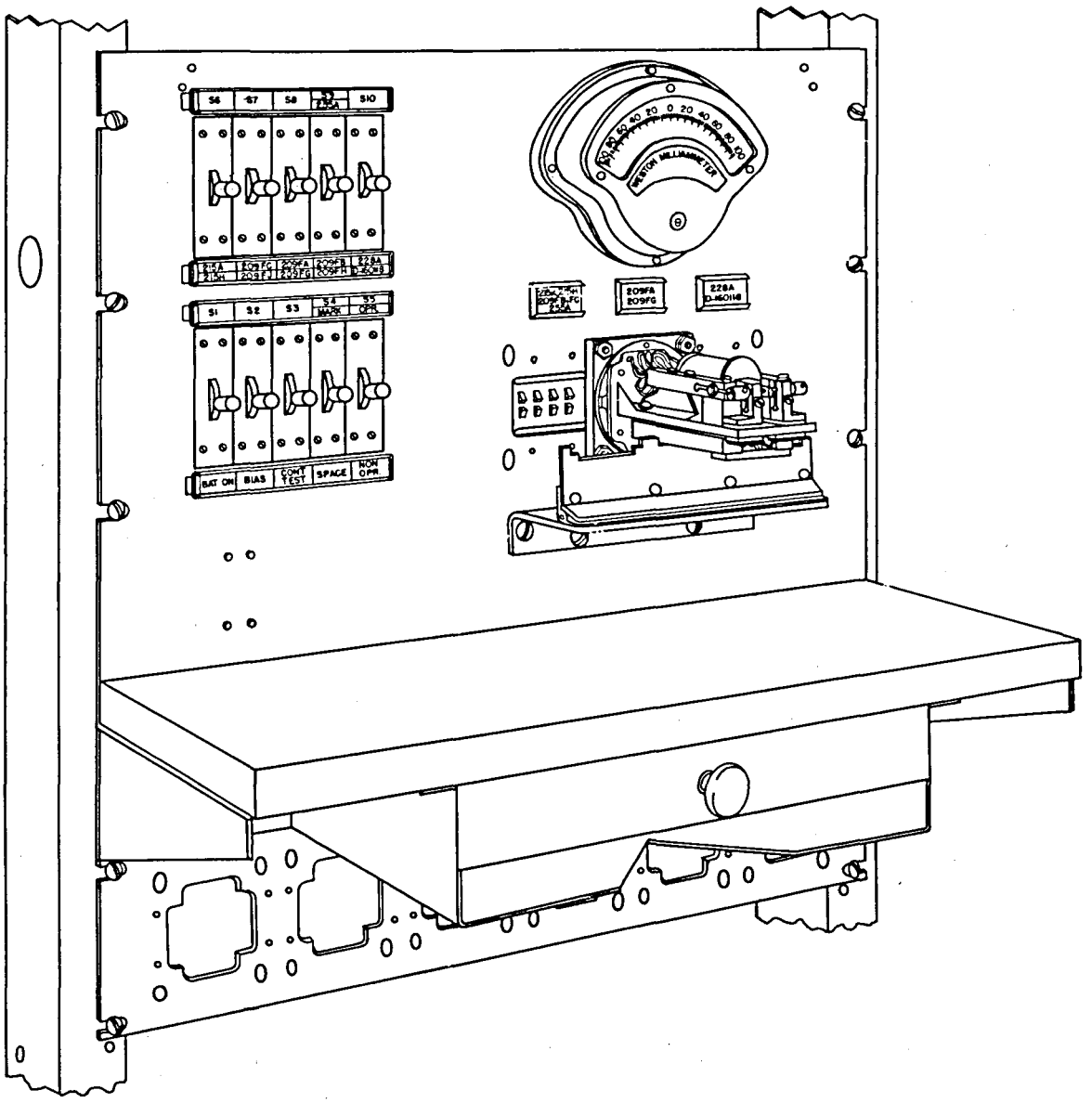


Fig. 1 - Front of Panel Mounted on a Relay Rack Bay with Shelf Assembly and Relay Storage Panel.

2. EQUIPMENT FEATURES

2.01 The testing equipment, consisting of keys, milliammeter, connecting blocks, resistances and condensers, is assembled on a steel panel and arranged to mount on a standard 19-inch relay rack bay as shown in Fig. 1.

2.02 When the 111A2 relay test panel is mounted on a relay rack bay a 7-inch shelf is provided, underneath which are located tool and logbook compartments. When required, to provide storage space for relays, storage panels to accommodate 6 relays each, are located above or below the 111A2 relay test panel.

2.03 The 111A2 relay test panel is also arranged to be mounted vertically on a standard mahogany table 3 feet long, 2 feet wide and 2 feet 6 inches high as shown in Fig. 2. A cabinet fastened on the rear of the table top is provided with storage space for 12 relays and has an adjustable lamp mounted on top.

2.04 Three 18-type connecting blocks are provided to accommodate the terminal blocks of any of the relays which may be tested or adjusted on the relay test panel. The three blocks A, B and C are designated as follows:

Block A

215A 215H
209FB, FC, FH, FJ
255A

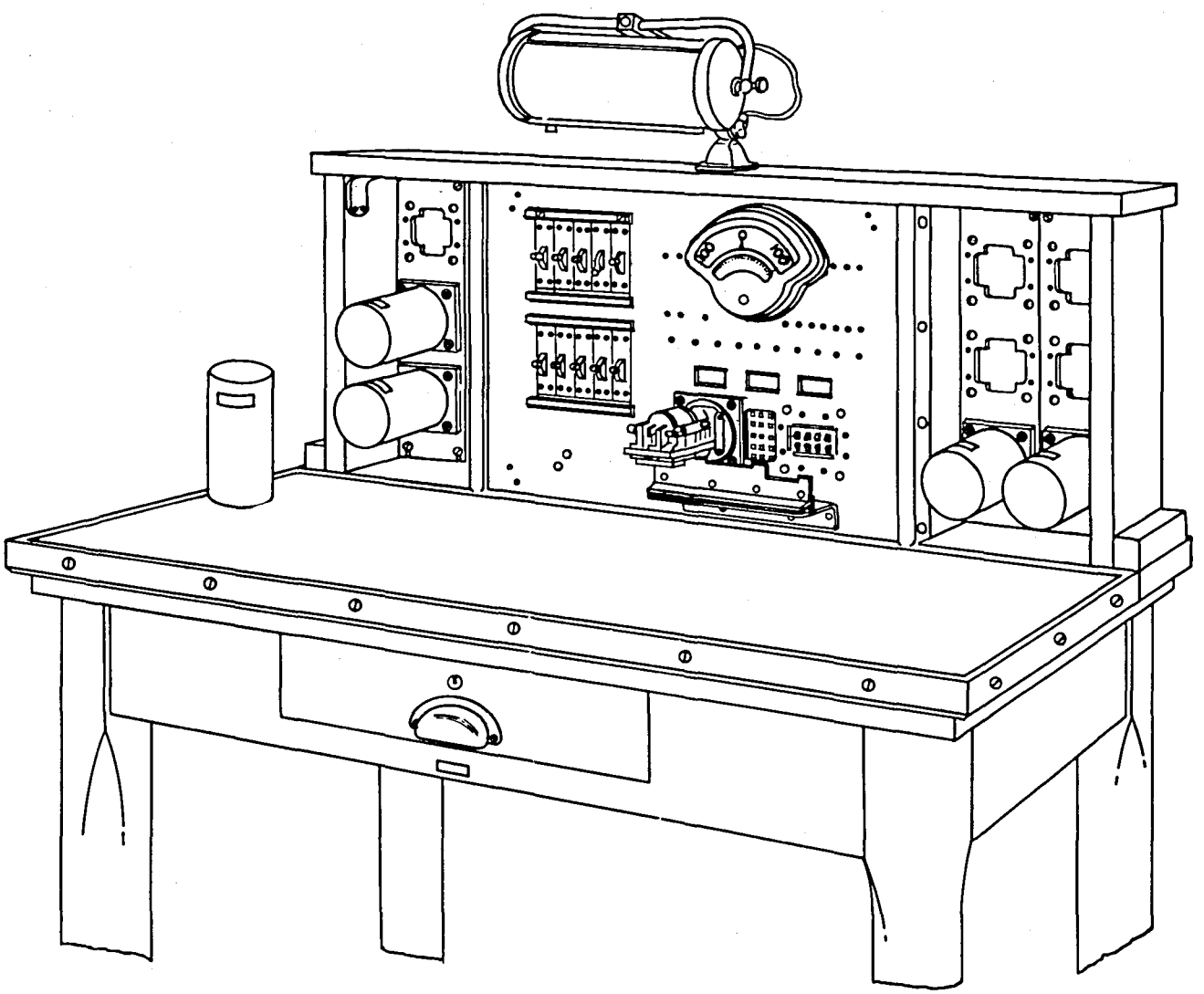


Fig. 2 - Front of Panel Mounted on a Relay Test Table.

Block B

209FA
209FG

Block C

228A
D-160118

2.05 The relay test panel is provided with a support for the relay under test. This support is hinged so that it may be raised up under the relay after the relay has been inserted in the connecting block.

2.06 Ten keys for controlling the tests are mounted on the test panel. The five keys, S6 to S10 which are mounted in the upper row form a selection group, while the other five keys, S1 to S5 mounted directly below the selection group, form a testing group.

2.07 A Weston Model No. 269 milliammeter per KS-7419 scale 100-0-100 is provided to indicate whether the relay under test is in proper adjustment.

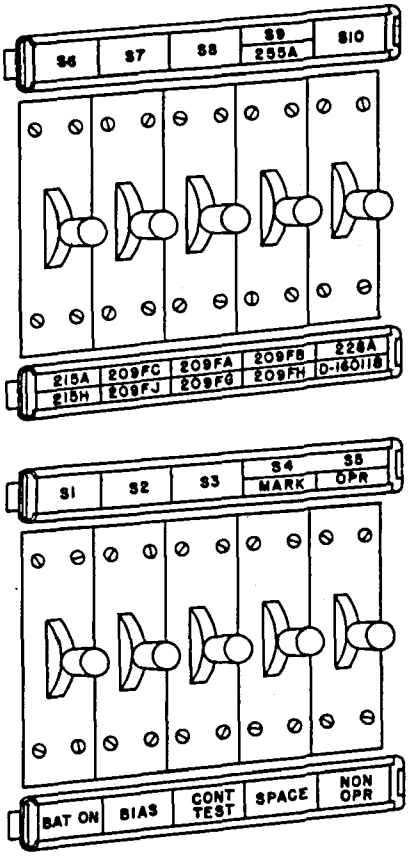
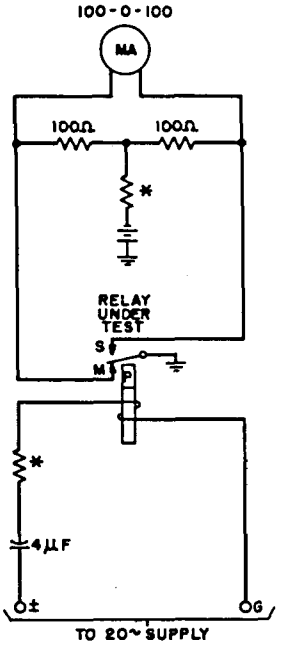


Fig. 3 - Key Designations



*See Fig. 7 for resistance and current values.

Fig. 4 - Bias Test

3. OPERATING FEATURES

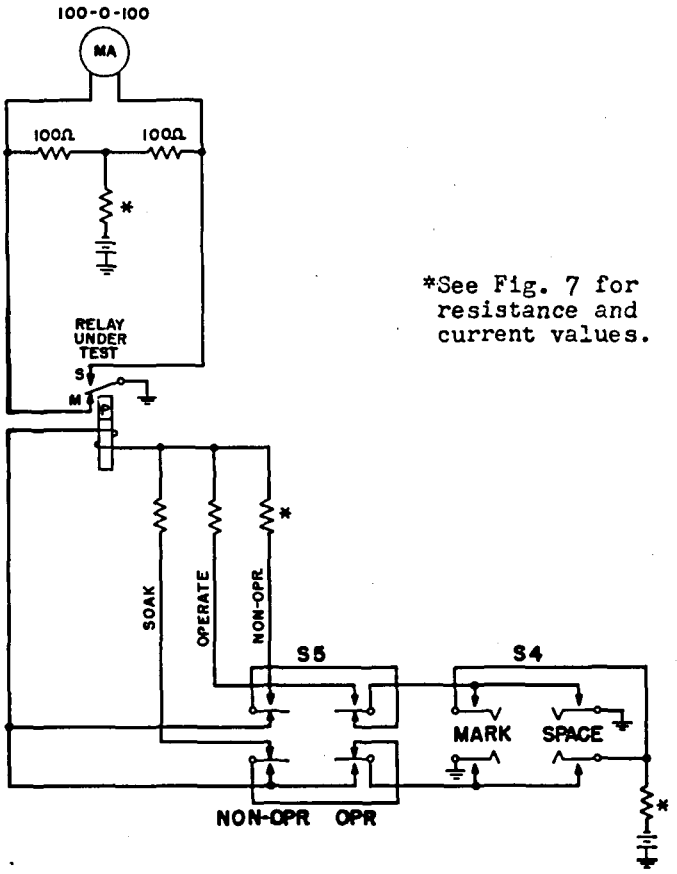
3.01 When using the relay test panel, the relay to be tested or adjusted is inserted into the proper connecting block. The other connecting blocks should be vacant.

3.02 One of the five selection keys (S6 to S10) is operated to set up the proper circuit for the particular relay to be tested. These keys are designated to correspond to the relay codes. Not more than one selection key should be operated at a time since this may result in improper testing currents being supplied. Fig. 3 shows the key designations.

3.03 Keys (S1 to S5) are operated in various combinations as required by the tests to be applied. The functions of these keys as indicated by their designations are as follows:

(a) Key S1 applies battery and 20-cycle supplies to the test circuit when operated to the BAT ON position. The battery may be ± 130 volts, ± 48 volts or -24 volts and corresponding resistances are provided for connecting in the circuit as required (Fig. 7).

(b) Key S2 is used for making the bias test (Fig. 4). When operated to the BIAS position this key connects 20-cycle current to the windings of the relay causing the relay armature to vibrate at approximately 20 cycles per second. A circuit containing a



*See Fig. 7 for resistance and current values.

Fig. 5 - Sensitivity Test

3.03 (Continued)

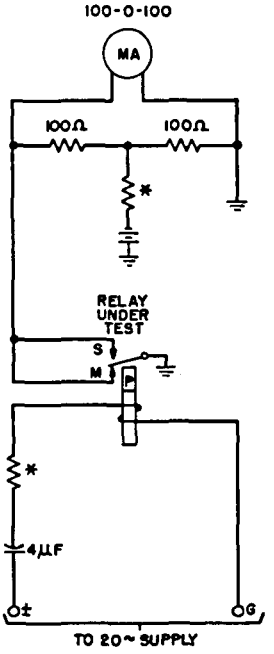
zero-center meter is connected to the contacts of the relay to indicate the per cent bias. If the needle vibrates either on the right (marking) or left (spacing) side of zero, there is bias in the relay.

(c) Key S3 is used for the contact test (Fig. 6). When operated to the CONT TEST position this key connects 20-cycle current to vibrate the armature as in the bias test, but the meter circuit is rearranged so that the relay contacts short-circuit the meter when either the S or M contact is made. The meter indication is to the right side always and it shows the relative portion of the time during which neither contact is closed because of travel time, dirty or poor contacts and contact chatter.

(d) Key S4 is simply a reversing switch for the sensitivity test (Fig. 5). In the sensitivity test "soak", "operate" and "non-operate" values of current are furnished to the relay windings which are connected series-aiding. When key S4 is operated to MARK the "operate" current tends to move the relay armature to the M contact. When key S4 is operated to SPACE the relay windings are reversed so that the same current tends to move the relay armature to the S contact. With key S4 in the normal position the circuit to the relay windings is open

(e) Key S5 is used to set up the circuits to provide the proper value and direction of current for the "soak", "operate" and "non-operate" tests (Fig. 5). When key S5 is normal (and key S4 operated, to SPACE, for example, "soak" current is applied in a direction to move the relay armature to contact M. When key S5 is held to the OPR position, the polarity of the connections to the relay is reversed and a much weaker "operate" current is applied which should move the relay armature to contact S. When key S5 is held to the NON-OPR position, a still weaker "non-operate" current is applied to the relay windings. The armature should not be operated and should remain on contact M.

3.04 Generally the bias test, sensitivity test and contact test should be made in this order although alternate bias and sensitivity tests are often desirable. In the case of the No. 228-A relay the bias test should be made first in order to set the relay at its zero bias point, since it is desirable that the relay have an approximate zero bias in order to insure a satisfactory contact test.



*See Fig. 7 for resistance and current values.

Fig. 6 - Contact Test

4. CIRCUIT FEATURES

4.01 Bias Test

(a) Position of Keys

Key S6, S7, S8, S9 or S10 to code of relay under test.
Key S1 to BAT ON.
Key S2 to BIAS.
Key S3 Normal
Key S4 Normal
Key S5 Normal

(b) In the bias test a predetermined value of 20-cycle current is applied to the windings of the relay (all windings connected in series) thus causing the relay armature to vibrate at this frequency (Fig. 4). The meter, which indicates the bias of the relay, is connected between the contacts M and S so that, if the armature rests on contact M for the same length of time that it rests on contact S, the meter needle will vibrate practically at mid-scale (zero). If the armature operates unsymmetrically, so as to rest longer on contact M, for example, the meter will indicate to the right of zero or marking bias. For the opposite condition, the meter will indicate to the left of zero, or spacing bias. The meter scale is 100-0-100 so that the readings indicate directly the per cent bias at 20 cycles per second. Any bias in the relay is generally due to causes such as improperly adjusted pole-pieces, contacts or armature.

4.02 Sensitivity Test - The sensitivity test circuit shown by Fig. 5, is employed to determine if the mechanical adjustments of the pole-pieces and armature are such as to give the desired sensitivity of operation of the relay. To make this test "soak", "operate" and "non-operate" values of current are furnished to the relay windings which are connected series-aiding.

(a) Position of Keys

Key S6, S7, S8, S9 or S10 to code of relay under test.
Key S1 to BAT ON.
Key S2 Normal.
Key S3 Normal.
Key S4 to SPACE.
Key S5 (Non-locking) held first to OPR and then to NON-OPR.

(b) With the keys set as above except for key S5 which is still normal, a "soak" current is applied to the relay windings which approximates the value experienced in normal use and holds the relay armature on its marking contact. The resistances in the circuit and the values of current are indicated in Fig. 7.

(c) When key S5 is held to the OPR position, a much lower value of current in the opposite direction to that of the "soak" current is applied to the relay windings which should move the armature from mark to space.

(d) When key S5 is held to the NON-OPR position, the previous value of "soak" current is again applied as the key passes through its normal position and then a value of current lower in value but in the same direction as the operate current is applied to the relay windings and this current should not move the armature.

(e) If the relay fails to respond when key S5 is operated to OPR, it is an indication that either or both of the pole-pieces are too close to the armature or that the armature travel is too large. If the relay responds when the key is operated to NON-OPR, either or both of the pole-pieces are not close enough to the armature or the armature travel is too small. Since the armature travel is usually set mechanically to the proper value before this test is made, the test is essentially an indication of the proper setting of the pole-pieces.

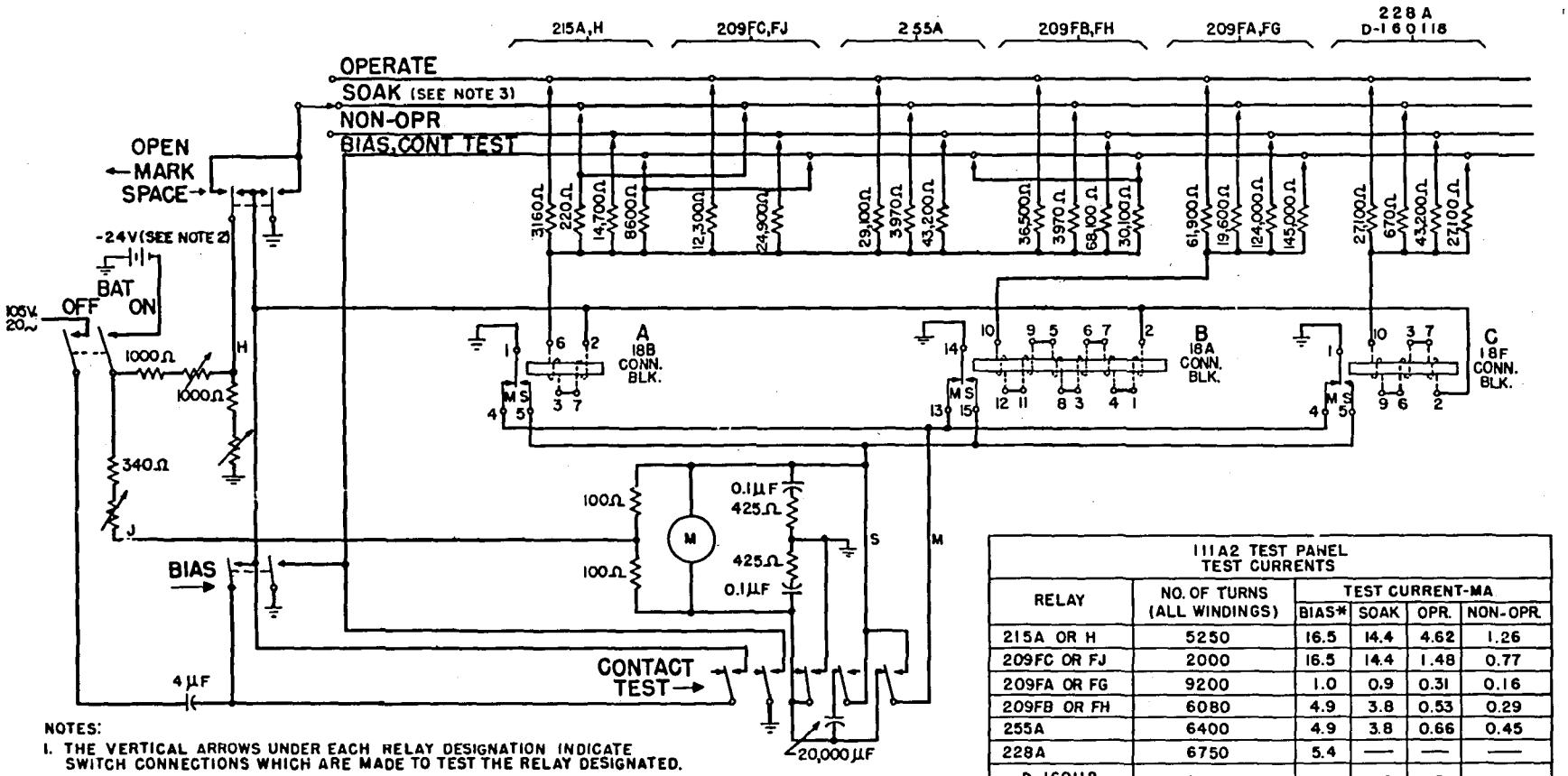
(f) The above sensitivity tests (c), (d) and (e) should be repeated with key S4 operated to MARK. Conditions are the same as described above except that the directions of current flow in the relay windings has been reversed. The soak current will hold the armature to the S contact and the operate current will tend to move the armature from the S to the M contact.

4.03 Contact Test

(a) Position of Keys

Key S6, S7, S8, S9 or S10 to code of relay under test.
Key S1 to BAT ON.
Key S2 Normal.
Key S3 to CONT TEST.
Key S4 Normal.
Key S5 Normal.

(b) The circuit for the contact test is illustrated in Fig. 6. It will be seen from this figure, that if the armature remains on either contact, ground is connected to both sides of the meter and the needle of the meter will stand at mid-scale (zero). If the armature remains in the middle and does not touch either one of the contacts, ground is connected to one side of the meter and battery to the other with the proper amount of resistance to cause the needle of the meter to deflect full-scale. When 20-cycle cur-

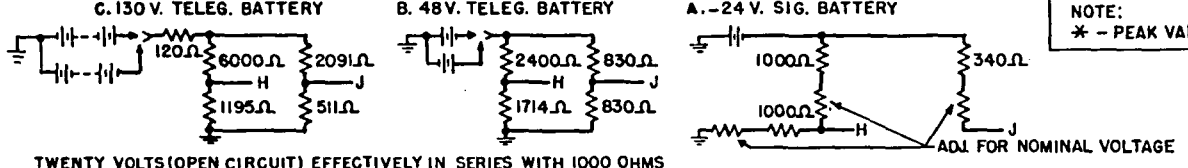


111A2 TEST PANEL TEST CURRENTS					
RELAY	NO. OF TURNS (ALL WINDINGS)	TEST CURRENT-MA			
		BIAS*	SOAK	OPR.	NON-OPR.
215A OR H	5250	16.5	14.4	4.62	1.26
209FC OR FJ	2000	16.5	14.4	1.48	0.77
209FA OR FG	9200	1.0	0.9	0.31	0.16
209FB OR FH	6080	4.9	3.8	0.53	0.29
255A	6400	4.9	3.8	0.66	0.45
228A	6750	5.4	—	—	—
D-160118 (MODIFIED 228A)	6750	5.4	9.3	0.70	0.45

NOTE:
* - PEAK VALUES.

NOTES:

1. THE VERTICAL ARROWS UNDER EACH RELAY DESIGNATION INDICATE SWITCH CONNECTIONS WHICH ARE MADE TO TEST THE RELAY DESIGNATED.
2. THE BATTERY SHALL BE A, B, OR C AS FOLLOWS:



TWENTY VOLTS (OPEN CIRCUIT) EFFECTIVELY IN SERIES WITH 1000 OHMS RESISTANCE IS SUPPLIED TO THE "H" LEAD BY ALL FIGURES. TWENTY VOLTS, WITH RELAY ARMATURE ON CONTACT, IS SUPPLIED BY THE "J" LEAD. REVERSING POINTS ARE PROVIDED (NOT SHOWN) TO TAKE CARE OF USING POSITIVE OR NEGATIVE BATTERY SUPPLY.

3. A REVERSING SWITCH (NOT SHOWN) REVERSES THE CURRENT FLOW FOR THE SOAK CONDITION, WITH RESPECT TO THE THE OPERATE AND NON-OPERATE CONDITIONS.

Fig. 7 - Schematic Circuit of 111A2 Relay Test Panel

4.03 (Continued)

rent is applied to the windings of the relay the armature vibrates at this frequency. If the relay is properly adjusted as to pole-gap and contact separation and has no armature chatter nor dirty contacts, the needle should indicate a value which is within the maximum allowable deflection established for the type of relay being tested. If the indication of the needle of the meter exceeds the maximum allowable deflection the relay is not in proper condition.

4.04 Drawing SD-70420-011 shows the complete circuit arrangement of the 111A2 relay test panel. The corresponding equipment drawing is ED-70529-01.