IB 7.4.1.7-4
Issue C

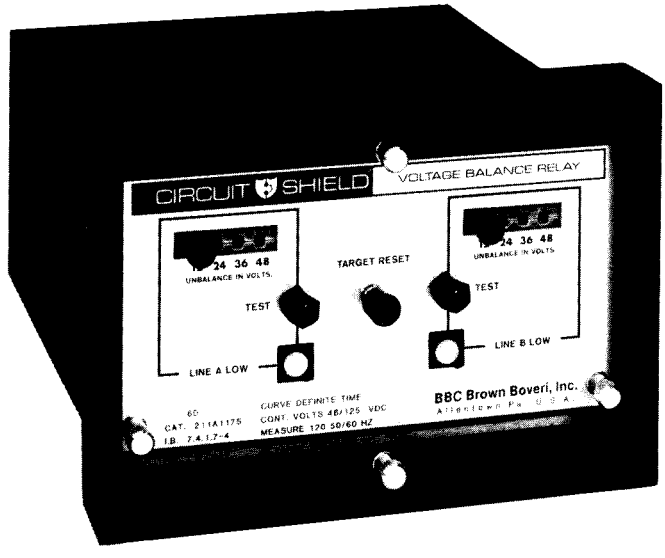
INSTRUCTIONS

Voltage Balance Relay

TYPE 60

Catalog Series 412A Test Case

Catalog Series 211A Standard Case



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INTRODUCTION

These instructions contain the information required to properly install, operate, and test the ABB Circuit-Shield™ Type 60 Voltage Balance Relay.

The relay is housed in a case suitable for conventional semiflush panel mounting. All connections to the relay are made at the rear of the case and are clearly numbered. Relays of the 412A catalog series have superseded units of the 211A series. Both series provide the same basic function and are of totally drawout construction; however, the 412A series relay provides integral test facilities. Also, sequenced disconnects on the 412A series prevent nuisance operation during withdrawal or insertion of the relay if the normally-open contacts are used in the application.

Most settings are made on the front panel of the relay, behind a removable clear plastic cover. The targets are reset by means of a pushbutton extending through the relay cover.

PRECAUTIONS

The following precautions should be taken when applying these relays:

1. Incorrect wiring may result in damage. Be sure wiring agrees with the connection diagram for the particular relay before energizing.

2. Apply only the rated voltage marked on the relay front panel. The proper polarity must be observed when the dc control power connections are made.

3. For relays with dual-rated control voltage, withdraw the relay from the case and check that the movable link on the lower printed circuit board is in the correct position for the system control voltage.

4. High voltage insulation tests are not recommended. See section on testing for additional information.

5. The entire circuit assembly of the relay is removable. The unit should insert smoothly. Do not use excessive force.

6. Follow test instructions to verify that the relay is in proper working order.

CAUTION: ***since troubleshooting entails working with energized equipment, care should be taken to avoid personal shock. Only competant technicians familiar with good safety practices should service these devices.***

PLACING THE RELAY INTO SERVICE

1. RECEIVING, HANDLING, STORAGE

Upon receipt of the relay (when not included as part of a switchboard) examine for shipping damage. If damage or loss is evident, file a claim at once and promptly notify Asea Brown Boveri. Use normal care in handling to avoid mechanical damage. Keep clean and dry.

2. INSTALLATION

Mounting:

The outline dimensions and panel drilling and cutout information is given in Fig. 1.

Connections:

Internal connections are shown in Figure 2. Typical external connections are shown in Figure 3. Control power must be connected in the proper polarity.

For relays with dual-rated control power: before energizing, withdraw the relay from its case and inspect that the movable link on the lower printed circuit board is in the correct position for the system control voltage. (For units rated 110vdc, the plug should be placed in the position marked 125vdc.) For older relays, catalog 211A1175, the upper circuit board must be removed to obtain access to the selector.

These relays have metal front panels which are connected through printed circuit board runs and connector wiring to a terminal at the rear of the relay case. The terminal is marked "G". In all applications this terminal should be wired to ground.

3. SETTINGS

UNBALANCE (VOLTS)
Tap blocks for each of the two lines are located on the relay front panel. Each tap block provides for four pickup settings: 12, 24, 36, and 48 volts. The relay operates instantaneously when the voltage unbalance exceeds the setting. Upon removal of a tap pin, the setting switches automatically to 48 volts.

Reset Time Delay
This internal adjustment is set at the factory for approximately 1 second. By adjusting potentiometers by test, the setting can be varied from approximately 0.5 to 1.2 seconds. This delay occurs upon restoration of balanced line voltage conditions.

4. INDICATORS

Targets:
An operation target is provided for each line. The target is set electronically when a low-line condition occurs and the output contacts transfer. The target will retain its indication on loss of dc control power. In order to reset the target, normal dc control power must be present and a balanced-voltage condition must exist.

Pickup Indicator:
A light-emitting-diode pickup indicator is provided on 412A series units for convenience in testing. The indicator lights when either operating condition (line A low or line B low) is present.

APPLICATION DATA

The ABB Circuit-Shield™ Type 60 Voltage Balance Relay provides fast differential voltage detection for three-phase systems. The typical application is in a redundant potential transformer arrangement, to detect a blown fuse and operate instantaneously to prevent improper tripping of other protective relays due to the loss in voltage.

As shown in Figure 3, input voltage to the relay is provided by two sets of potential transformers whose primaries are connected to the same bus. The relay compares the magnitude of the voltage at relay terminals 1-2 with that at 4-5, and the voltage at 2-3 with that at 5-6. In normal operation the voltages will be equal, typically at approximately 120 volts. In the event of a fault on the system, the voltages will be lower but still approximately equal, and the relay will not operate. However, should one of the pt's fail, blowing its fuse, the secondary voltage will drop and the Type 60 will operate instantaneously.

Typically the relay's output contacts would be used to block tripping by voltage-controlled overcurrent relays, to block voltage regulating equipment, and to sound an alarm. The Type 60 provides (1) double-pole double-throw (form C) contact for each output. Since additional contacts will usually be required by the scheme, a fast auxiliary relay should be used to multiply contacts.

On restoration of balanced voltages, the 60A or 60B output contacts will return to the "normal" postion after the expiration of a time delay. This delay is set at the factory for 1 second. An internal adjustment provides a range of approximately 0.5 to 1.2 seconds.

Note: for sensitive protection against unbalances in a three-phase bus voltage, as commonly required for the protection of motors, refer to the ABB Type 60Q Voltage Unbalance Relay, IB 7.4.1.7-3 .

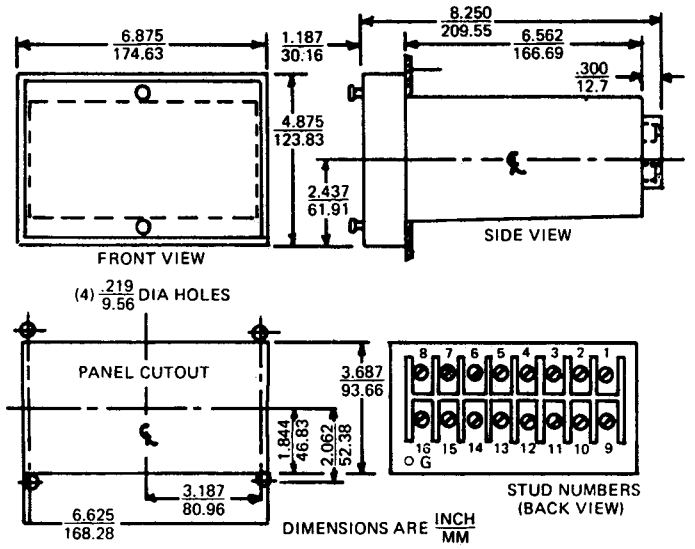


Figure 1: Relay Outline and Drilling

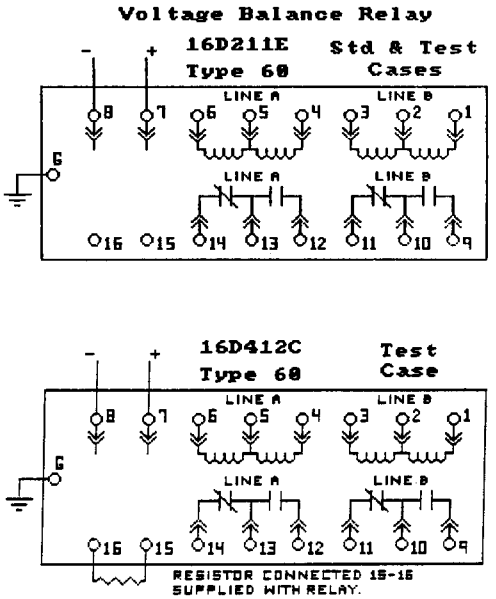


Figure 2: Internal Connections

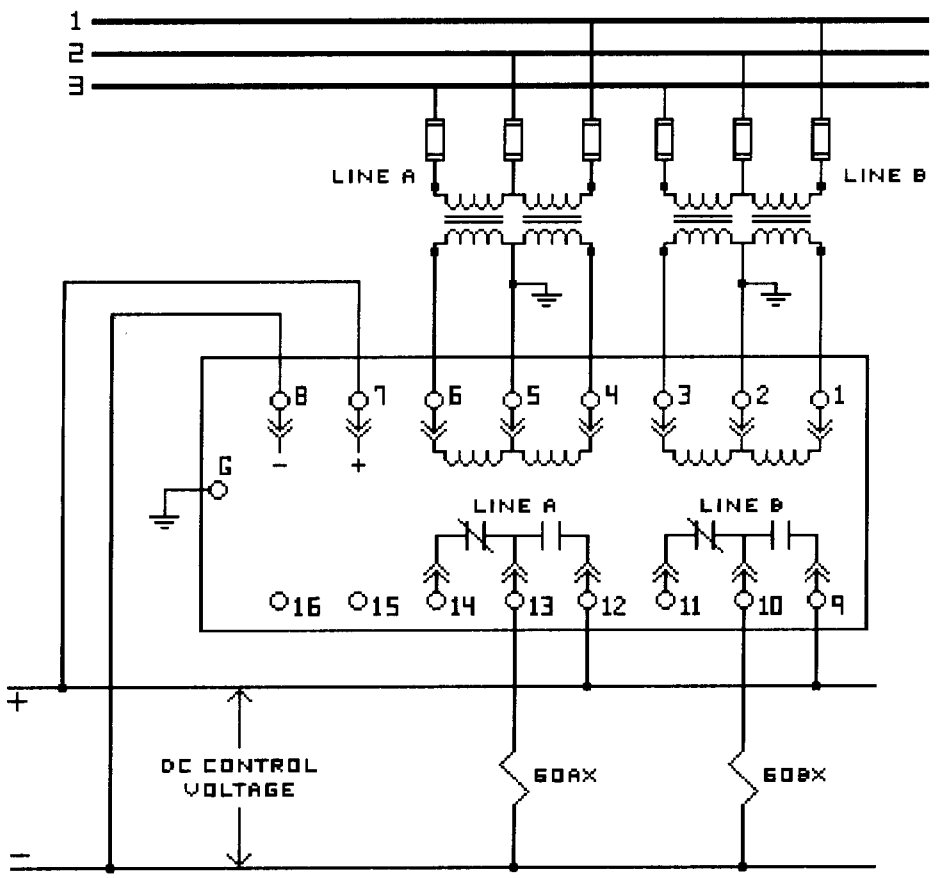


Figure 3: Typical External Connections

SPECIFICATIONS

Input Circuit:

Rating: 160V, 50/60 Hz. continuous.
300V, 10 seconds.

Burden: 211A series units: 0.7 VA, 1.0 pf at 120 volts.
412A series units: 0.2 VA, 1.0 pf at 120 volts.

Taps: 12, 24, 36, 48 volts unbalance.

Tolerance: +/- 10%.

Operating Time:

Typical: 0.010 second for complete loss of voltage on one input.
Maximum: 0.016 second for complete loss of voltage on one input.

Reset Delay: adjustable approximately 0.5 - 1.2 seconds.

Output Circuit:

each contact	@125vdc	@250vdc
tripping	30A	30A
continuous	5A	5A
break	0.3A	0.1A

Operating Temperature Range: -30 to +70 degrees C.

Control Power: models available for:

48/125 vdc @ 0.04 A max.
48/110 vdc @ 0.04 A max.
24/ 32 vdc @ 0.06 A max.
220 vdc @ 0.04 A max.
250 vdc @ 0.04 A max.

Allowable variation:

24v	nominal:	19- 29 vdc
32v	"	25- 38
48v	"	38- 58
110v	"	88-125
220v	"	176-250
125v	"	100-140
250v	"	200-280

Dielectric Strength:

412A series units: 2000 vac, 50/60 Hz., all circuits to ground.
211A series units: 1500 vac, 50/60 Hz., all circuits to ground.

Seismic Capability:

More that 6g ZPA biaxial broadband multifrequency vibration without damage or malfunction. (ANSI C37.98-1978)

CATALOG NUMBERS - COMMON UNITS

Type	Control Voltage	Internal Connections	Catalog Numbers Std Case	Test Case
60	48/125vdc	16D211E	211A1175	412A1175
	48/110vdc	"	--	412A1105
	24/ 32vdc	"	--	412A1195
	220vdc	16D412C	--	412A1125
	250vdc	"	--	412A1155

Test case units preferred for new applications, due to improved test features.

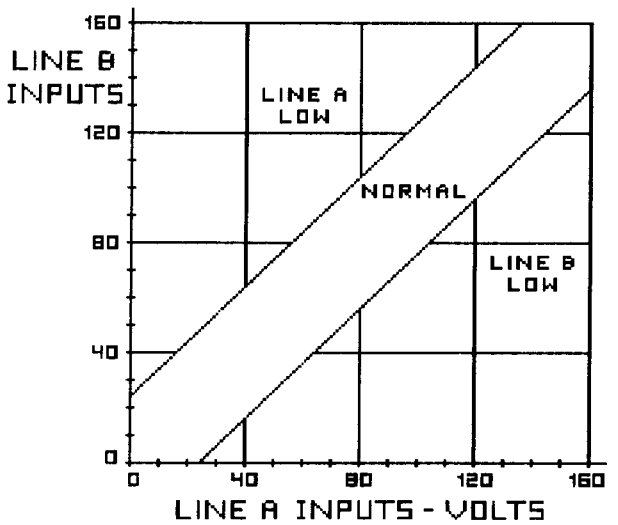


Figure 4: Operating Characteristic, Shown for the 24v Tap Setting

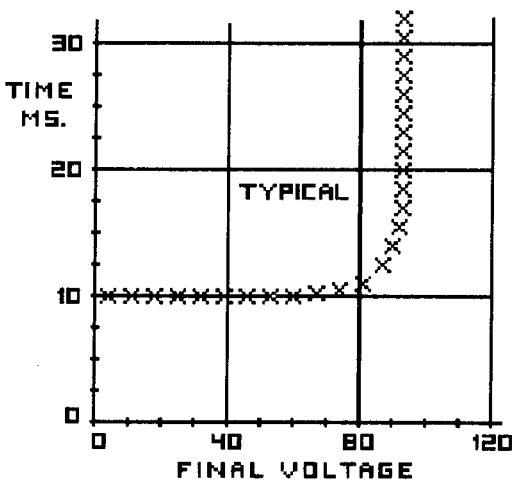


Figure 5: Typical Operating Time, with a 24v Tap Setting for the Reduction of one Input Line Voltage.

TESTING

1. MAINTENANCE AND RENEWAL PARTS

No routine maintenance is required on the ABB Type 60 relay. Follow test instructions to verify that the relay is in proper working order. We recommend that an inoperative relay be returned to the factory for repair; however, a schematic diagram will be provided on request. Renewal parts will be quoted by the factory on request.

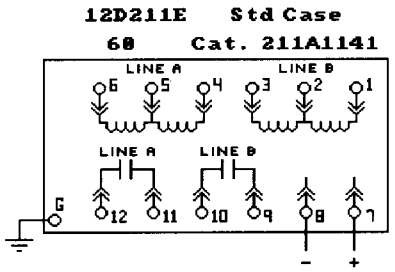
211A Series Units
Drawout circuit boards of the same catalog number are interchangible. A unit is identified by the catalog number stamped on the front panel and the serial number stamped on the bottom side of the drawout circuit board.

The board is removed by using the metal pull knobs on the front panel. Removing the board in service ***may cause an operation.***

An 18 point extender board (cat 200X0018) is available for use in troubleshooting.

Units with catalog numbers 211A1141 and 211A1175 are obsolete. A 211A1175 may be directly replaced with a 412A1175 since the connections are the same: diagram 16D211E. The connections for a 211A1141 unit are shown in diagram 12D211E. If a 211A1141 is to be replaced with a 211A1175 or a 412A1175, the entire unit including the case must be replaced, and the wires that were on terminals 11 and 12 must be rewired to terminals 12 and 13 (see Figures 2 and 3).

Internal Connection Diagram
12D211E
for
Catalog Number 211A1141
(obsolete)



412A Series Units
Metal handles provide leverage to withdraw the relay assembly from the case. Removing the unit in an application that uses the normally-closed contact will cause an operation. The assembly is identified by a catalog number stamped on the front of the unit and a serial number stamped on the bottom of the board.

Test connections are readily made to the drawout relay unit by using standard banana plug leads at the rear vertical circuit board. This rear board is marked for easier identification of the connection points.

Should separation of the upper and lower circuit boards be needed, remove (2) screws that attach the left and right handle assemblies to the upper printed circuit board. Disconnect the 3 conductor cable that connects the upper circuit board to the lower board. The lower board may then be withdrawn forward from the printed circuit connector. An 18 point extender board (cat. 200X0018) is available from the factory if access to the lower circuit board is required for troubleshooting. A temporary cable connection must be made from the upper to lower circuit boards.

A test plug assembly, cat. 400X0002, is available for use with the 414 series units. This device plugs into the relay case on the switchboard and allows access to all external circuits wired to the case. See Instruction Book IB 7.7.1.7-8 for details on the use of this device.

2. HIGH POTENTIAL TESTS

High potential tests are not recommended. A hi-pot test was performed at the factory before shipping. If a control wiring insulation test is required, partially withdraw the relay unit from the case sufficient to break the rear connections before applying the test voltage.

3. BUILT-IN TEST FEATURE

Tests should be made with the main circuit de-energized.

A built-in trip-test feature is provided as a convenient means of testing the basic operation of the relay and associated auxiliary circuits. DC control power must be present to run the test. The test may be performed with or without AC voltage input to the relay.

When the TEST button associated with the LINE A setting is depressed, a low-line condition is simulated. The contacts associated with terminals 12-13-14 should transfer instantaneously and a LINE A target should be displayed. On release of the test button, the contacts should return to normal after the reset delay time elapses. Similarly, actuation of the LINE B test button should cause contacts 9-10-11 to transfer. The pickup led should light when either button is actuated.

4. ACCEPTANCE TESTS - 412A Series Units

Typical test connections are shown in Figure 6. Set the desired Voltage Unbalance taps on the relay. Apply rated control voltage (check the position of the control voltage selection link on the circuit board first).

The connections shown in Fig.6 are arranged to lower the line A voltage to terminal 6 of the relay. With switch SW1 thrown to apply the output of the variable transformer to the Line A input, gradually lower the voltage until the Pickup light comes on and the Line A contacts (12-13-14) transfer. The voltage difference read on the voltmeter should be within +/-10 percent of the tap setting. The Line A target should operate.

Reset the timer. Throw switch SW1 to reapply normal line voltage. The timer will record the reset time. The factory setting is 0.9-1.1 seconds. If a different setting is to be used for the application, it may be made by repeating this test and adjusting internal potentiometer R35 to obtain the desired time.

To complete the testing for the other three relay inputs, change the test connections as shown in the chart below and repeat the tests. Line B reset time is set with potentiometer R39.

TEST	Point T to	Line L to	Should Transfer	Target
Line A, 4-5	4	1, 3, 6	12-13-14	LINE A
Line B, 1-2	1	3, 4, 6	9-10-11	LINE B
Line B, 2-3	3	1, 4, 6	9-10-11	LINE B

5. OTHER TESTS

The Type 60 typically operates in about 10 milliseconds on a complete loss of voltage; therefore, due to errors in the test equipment and point-on-wave effects, it is very difficult to make a meaningful operating time check. An electronic timer connected to start when switch SW1 is actuated to lower the voltage, and stop when the relay contacts transfer, can be used as a rough check on operating time. However, if the application requires a very accurate check of this characteristic, a dual-channel storage-oscilloscope monitoring both the ac input voltage and the contact transfer must be used.

6. ACCEPTANCE TESTS - 211A1175 Series Units

Units of catalog number 211A1175 are tested in the same way as 412A series units, however, the potentiometers for adjusting the reset delay are labelled R26 and R27.

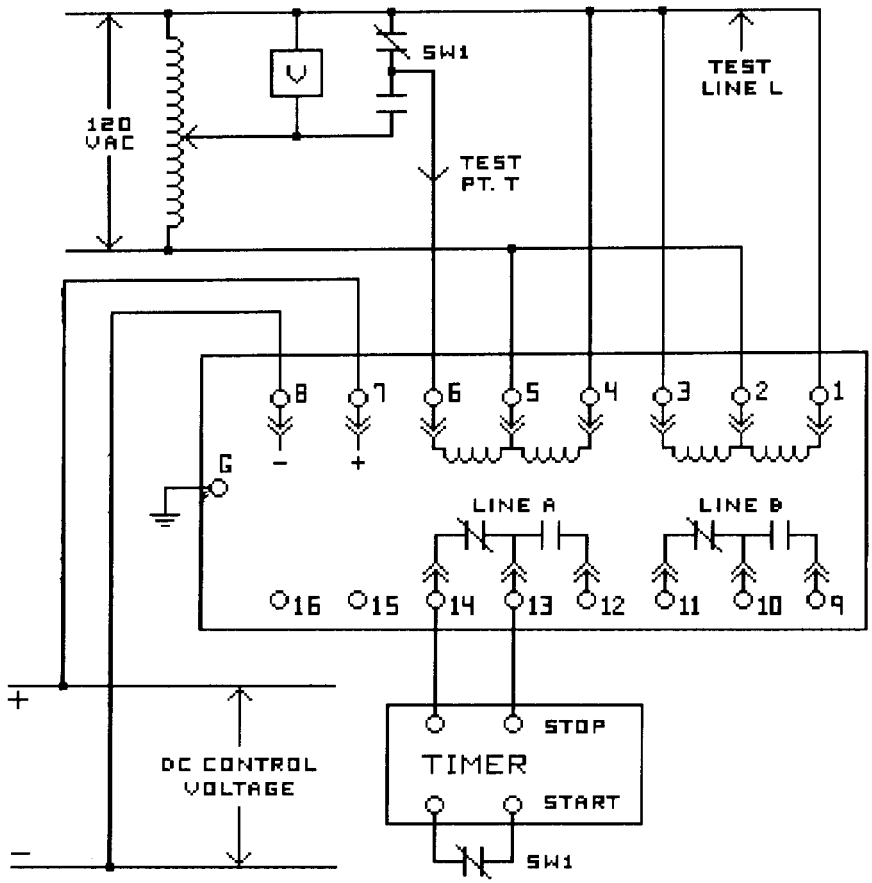


Figure 6: Typical Test Connections

Important: *Units constructed per internal connection diagram 16D412C have an external resistor connected between terminals 15 and 16. (See diagrams on page 4 and table on page 5.) In order to test the drawout element of these particular units, a resistor must be connected temporarily between terminals 15 and 16 on the rear vertical circuit board.*

The value of this resistor depends on the control voltage rating of the relay. For units rated 220vdc or 250vdc use 10000 ohms for testing. A 25 watt rating is sufficient for testing purposes.

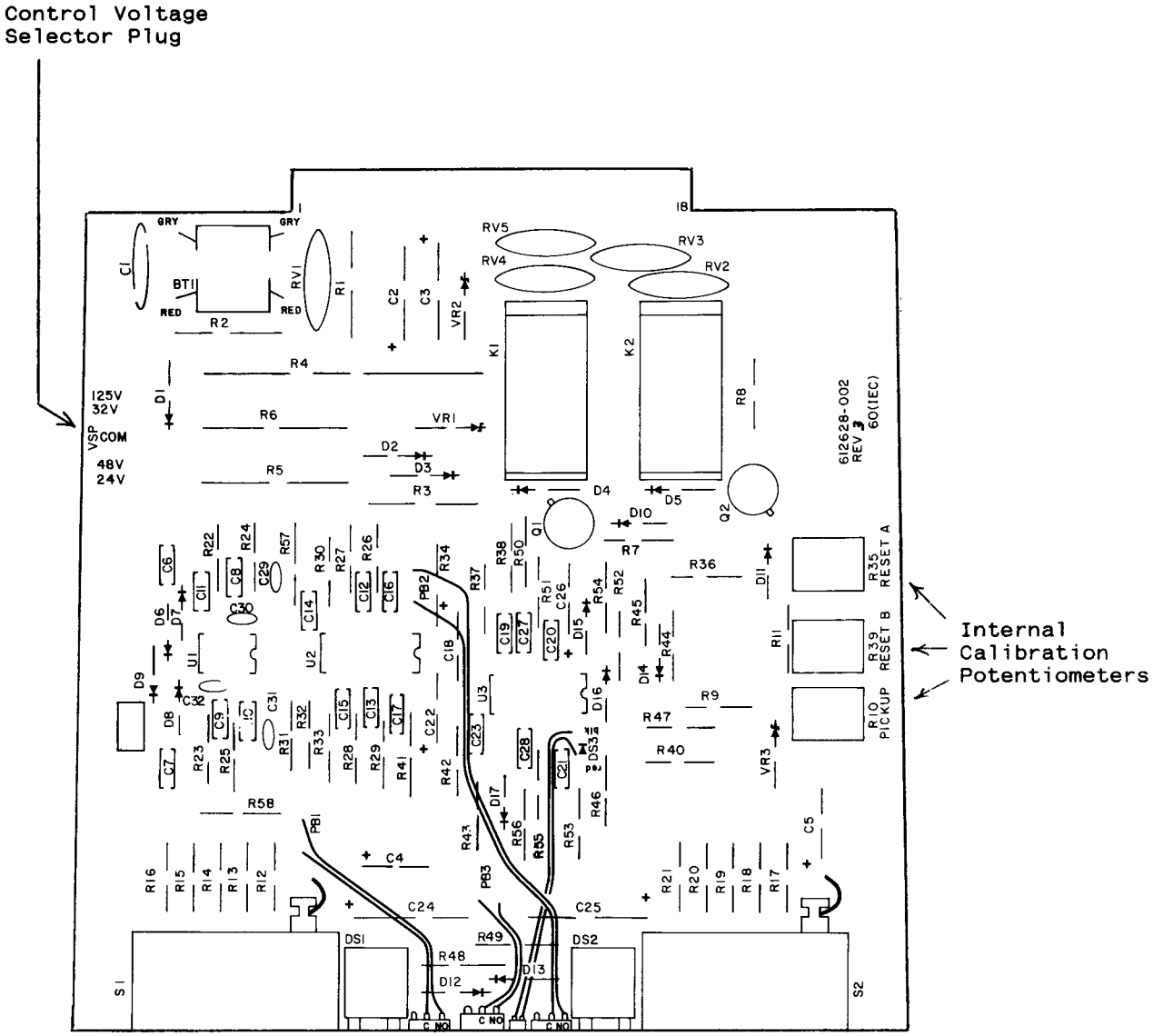


Figure 7: Typical Layout, Lower Printed Circuit Board

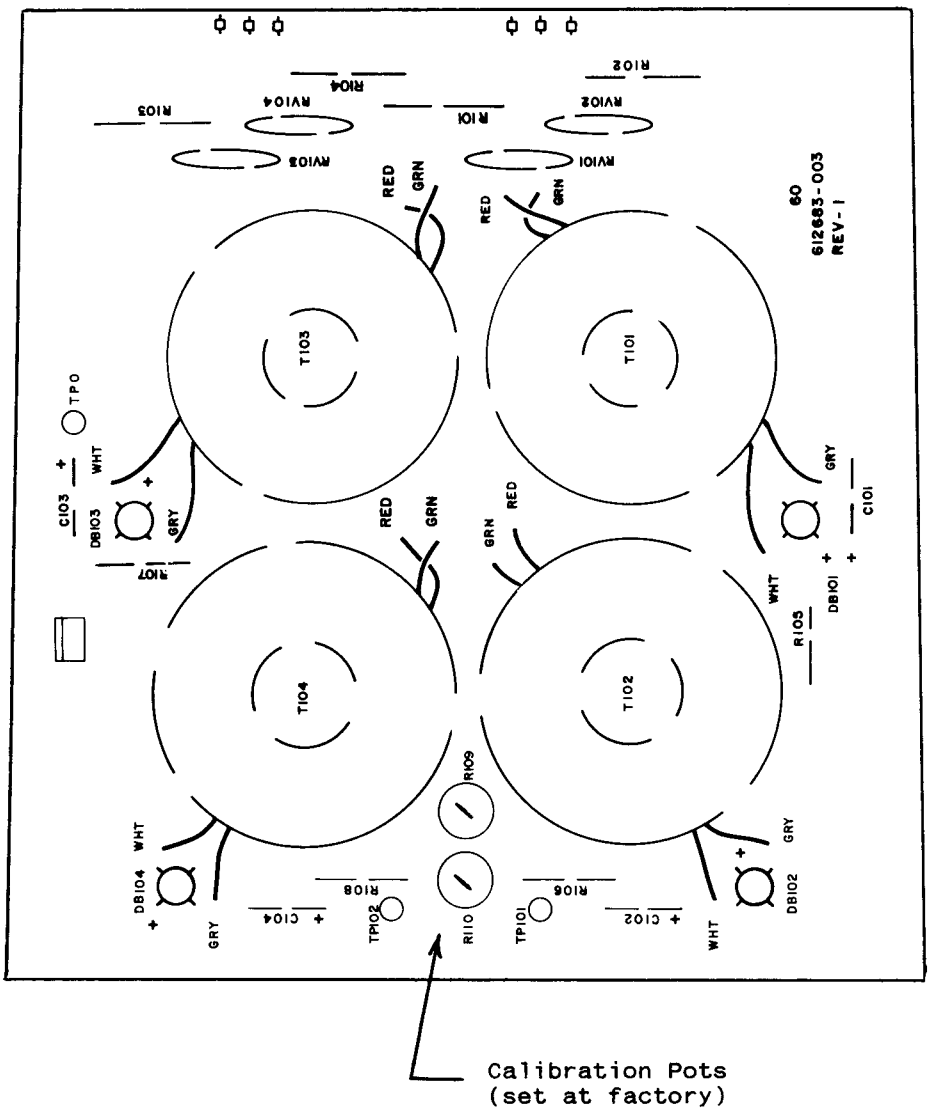


Figure 8: Typical Layout, Upper Printed Circuit Board