IB 7.3.1.7-1
Issue C

INSTRUCTIONS

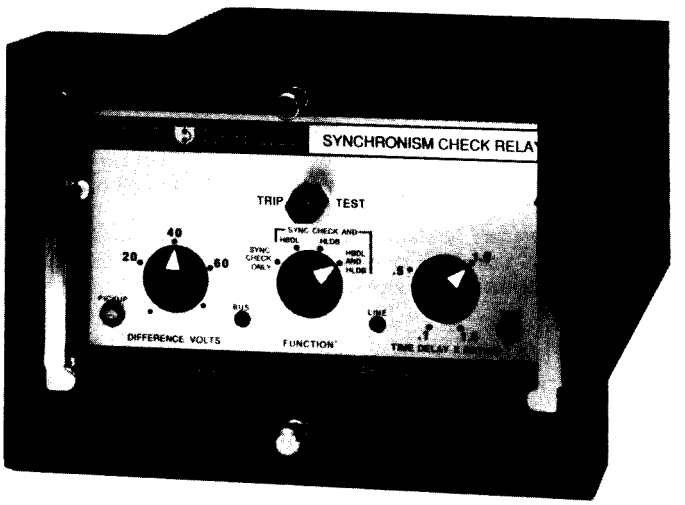
Synchronism Check Relays

TYPE 25S SYNCHRONISM CHECK ONLY

TYPE 25V SYNC CHECK with DEAD-BUS DEAD-LINE OPTIONS

Catalog Series 424J/424K • Test Case

Catalog Series 224J/224K • Standard Case



Type 25V

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INTRODUCTION

These instructions contain the information required to properly install, operate, and test the ABB Circuit-Shield™ Types 25S and 25V Synchronism Check Relays.

These relays are 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 424 catalog series are similar to relays of the the 224 series. Both series provide the same basic functions and are of totally drawout construction; however, the 424 series provide integral test facilities.

Settings are made on the front panel of the relay, behind a removable clear plastic 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 relay before energizing.

2. High voltage tests are not recommended. See the section on Testing for additional information.

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

4. 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 and a typical external connection diagram are shown in Figure 2.

No control power is required for this relay; however, at least 90V, 50/60Hz. must be present at either the line or bus input terminals in order to energize the relay.

The Type 25 relay has a metal front panel which is connected through printed circuit board runs and connector wiring to a terminal at the rear of the relay case. This terminal is marked "G". In all applications this terminal should be wired to ground.

3. SETTINGS

MAGNITUDE OF VECTOR DIFFERENCE VOLTAGE

This setting, continuously adjustable from approximately 0 to 80 volts, determines the closing characteristics of the relay. Refer to Figure 3 for the effect of this setting.

TIME DELAY

This setting determines the time that the two souces must be in synchronism (by the criteria of the Difference Voltage setting) before the relay's output contacts will transfer. The set time delay in seconds equals the dial setting times the nameplate rating. The two most common models have nameplate ratings of 1 sec. (range 0.1-1.5 seconds), or 10 sec. (range 1-15 seconds).

The following settings are provided only on the Type 25V relay:

FUNCTION

This switch permits the selection on any one of the following conditions, *in addition to the "normal" sync check function*, to allow closing. In all of the following selections, if both sources are live, a normal sync check measurement is made.

HOT BUS -- DEAD LINE (HBDL)
HOT LINE -- DEAD BUS (HLDB)
HOT BUS -- DEAD LINE or HOT LINE -- DEAD BUS

In the SYNC CHECK ONLY position, the relay operates only in the synchronism check mode, per the criteria of the Difference Voltage and Time Delay settings.

BUS and LINE adjustments

The voltage levels at which the bus or line are considered "Hot" is settable by means of these screwdriver adjustments located on the front panel. The voltage levels are independently adjustable from approximately 0 to 120 volts. A typical setting would be 30 volts.

4. INDICATORS

Light emitting diode indicators are provided to assist in testing and to provide operating personnel with information on the status of the relay. The PICKUP indicator comes on when the Line and Bus voltages meet the Difference Voltage setting criteria (or the dead-bus, dead-line conditions if set on the Type 25V). The TIME indicator lights at the end of the time delay period when the output contacts transfer.

APPLICATION DATA

These relays are used to verify that the voltages on either side of a circuit breaker are synchronized, and in the proper phase and magnitude relationship to permit closing.

The Type 25S allows closing when both the bus and line voltages are approximately normal, equal, in phase, and of approximately the same frequency.

The Type 25V provides the same functions, but also includes options to allow closing when either the line or bus is dead. A switch on the front panel of the relay allows easy selection of the option most suitable for the particular operating practices for the system. The options provided are: sync check only; hot bus-dead line; hot line-dead bus; hot bus-dead line or hot line-dead bus.

IMPORTANT: in ALL positions of the FUNCTION switch, the Type 25V provides the normal synchronism check function when both the line and the bus are hot. In other words, with both sources hot, closing will be allowed only if the criteria of the Difference Voltage and Time Delay settings are satisfied.

The Types 25S and 25V include precise solid-state measuring and time delay circuitry, with calibrated, adjustable controls.

Low burden, fast reset, and a high continuous input voltage rating are significant advantages of the Types 25S and 25V over equivilent electromechanical types.

The fast dropout time of approximately 1 cycle allows the use of these relays for supervision of fast motor bus transfer schemes. It also allows the use of the relay in high-speed reclosing schemes without supervision by a 52/b contact.

Principles of Operation: Referring to Figure 3, assume a Source A at 120 volts, zero degrees to be the reference. The Difference Voltage setting is represented by a circle drawn with the Source A reference vector at its center. When the vector representing Source B enters the circle the first criteria for synchronism is met and the electronic internal timer is started. If the Source B vector remains in the circle for the time period set on the Time Delay dial, the second criteria is met and the output contacts will transfer to allow breaker closing. (Should the Source B vector leave the circle before the end of the time delay, the timer will reset to zero and the output contacts will not transfer.)

Therefore, the following will apply: 1) A smaller Difference Voltage setting is a more restrictive criteria; 2) A longer Time Delay setting is a more restrictive criteria.

Figure 4 is an example of the relationship between the Difference Voltage and Time Delay settings. Figure 4 assumes both sources are at 120 volts. It shows for any pair of settings what the maximum slip frequency can be, and just obtain relay contact transfer. For example: for a Difference Voltage setting of 40 volts and a Time Delay setting of 1 second, the slip frequency between the sources must be approximately 0.1 Hertz or less to obtain contact transfer. Increasing the Time Delay setting to 10 seconds makes the criteria for closing more restrictive: the slip frequency must be 0.01 Hertz or less to obtain relay operation.

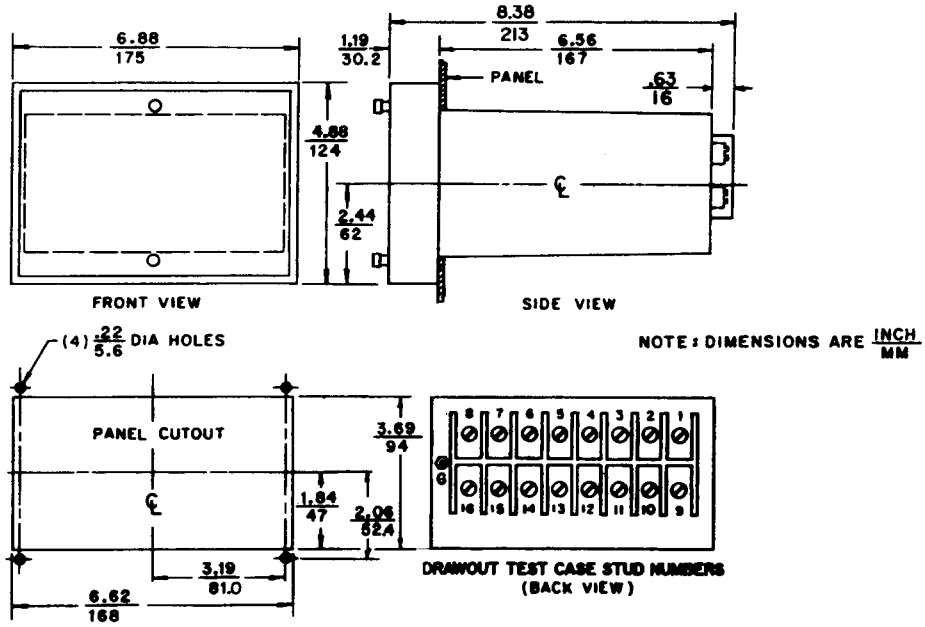

FIGURE 1: RELAY OUTLINE AND PANEL DRILLING

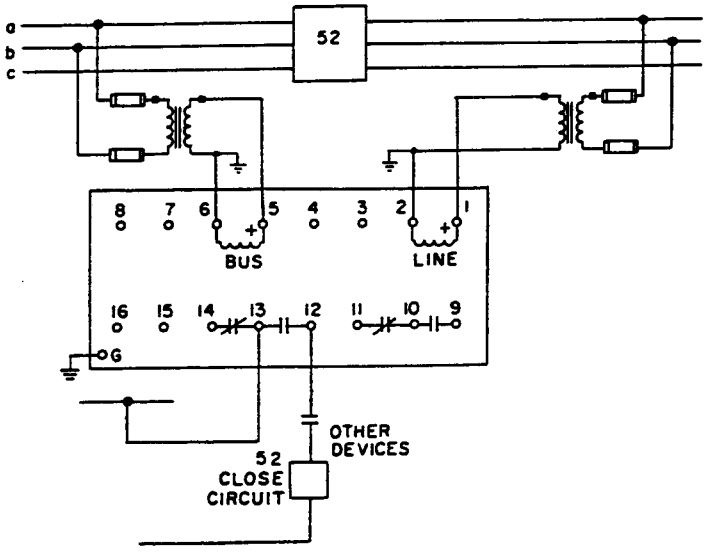

FIGURE 2: INTERNAL CONNECTIONS AND TYPICAL EXTERNAL CONNECTIONS

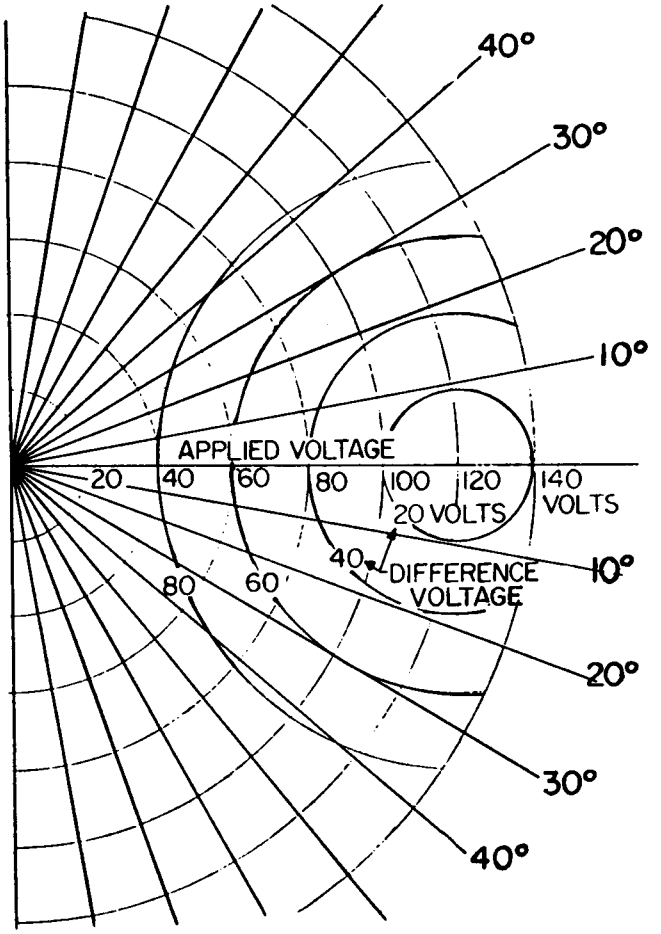

FIGURE 3: TYPICAL VOLTAGE DIFFERENCE CLOSING CHARACTERISTIC FOR A 120 VOLT 50/60 HZ RELAY WITH RATED VOLTAGE ON ONE INPUT CIRCUIT

SPECIFICATIONS:

Input Voltage: 120 Volts, 50/60 Hz. nominal.
140 Volts maximum continuous,

Each input must be taken from the same phase and be sinusoidal for proper relay operation.

At least 90 Volts must be present at either the line or bus input terminals in order to energize the relay.

Burden: Nominal - 1VA per input.
Worst Case (HBDL or HLDB) - 2VA on energized input.

Magnitude of Vector Difference Voltage: Approximate Range of Adjustment - 0 to 80 volts.
Dial Calibration Marks at 20, 40, and 60 volts.

Tolerance +/-10% of dial setting.
Repeatability at 25°C +/-1% of set point.
Repeatability -20 to +70°C +/-5%.

Time Delay: Standard Models 0.1-1.5 seconds, or 1-15 seconds.

Tolerance +/-10% of dial setting.
Repeatability at 25°C +/-1% of set point or +/-1 cycle whichever is greater.
Repeatability -20 to +70°C +/-5% of set point or +/-1 cycle whichever is greater.

Dropout Time approximately 1 cycle.

Dead Bus, Dead Line Levels (Type 25V only): Adjustable approximately 0 to 120 volts,
Nominal factory setting 30 volts.

Operating Temperature Range: -20 to +70° C.

Output Contacts: Ratings at 125 Vdc:
30A closing
5A continuous
0.3A break inductive

Dielectric Strength: 2000 Vac RMS, 1 minute.

CHARACTERISTICS OF COMMON UNITS

Type	Function	Time Delay Range	Catalog Numbers Standard Case	Catalog Numbers Drawout Test Case
25S	Sync Check	1 - 15 seconds	224J1105	424J1105
		0.1-1.5 seconds	224J2105	424J2105
25V	Sync Check with Dead Bus, Dead Line Options	1 - 15 seconds	224K1105	424K1105
		0.1-1.5 seconds	224K2105	424K2105

Note: catalog series 424 units should be specified for new applications, due to the improved test features.

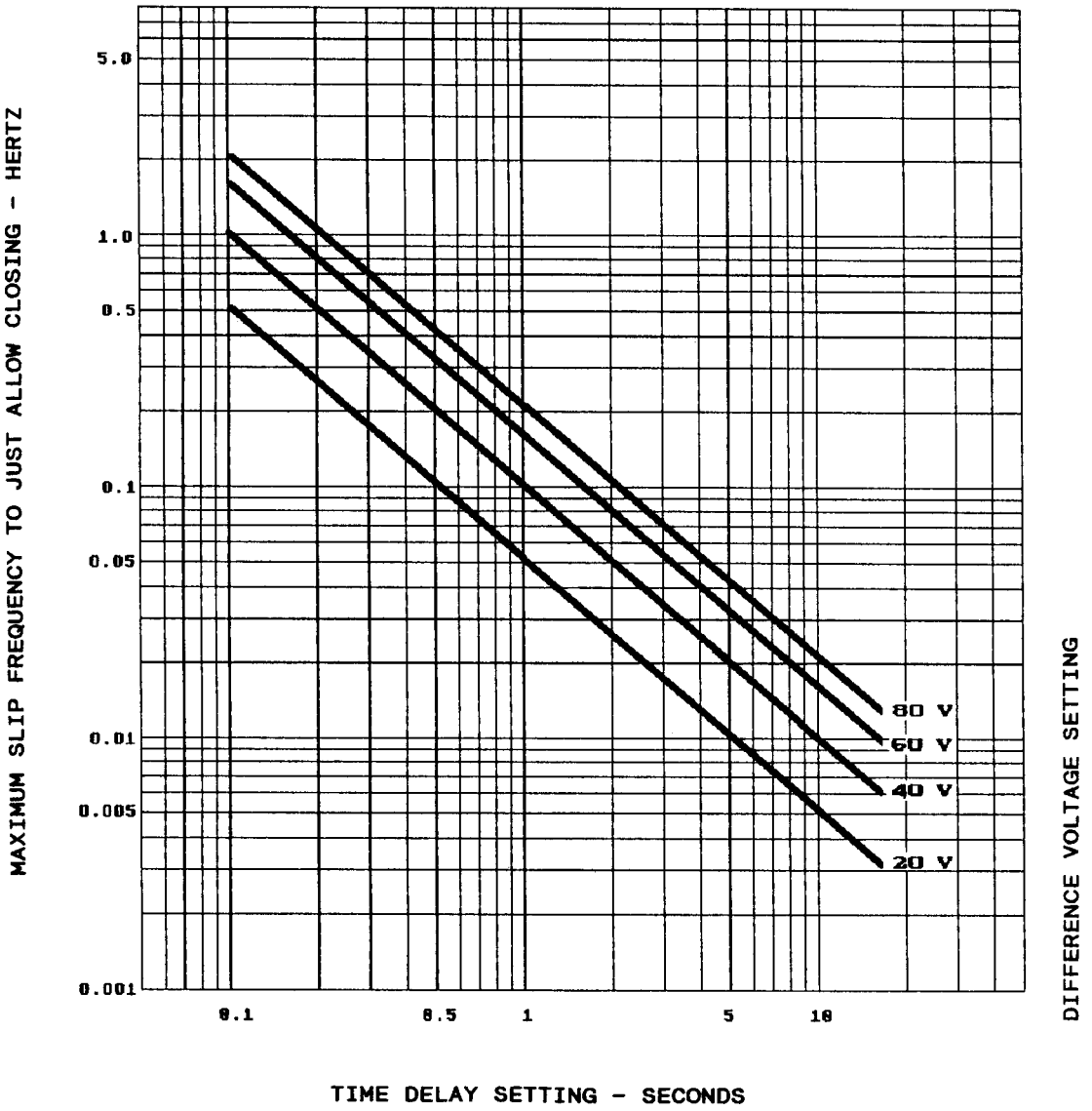

FIGURE 4: MAXIMUM SLIP FREQUENCY AT WHICH CLOSING WILL JUST OCCUR AS A FUNCTION OF RELAY'S TIME DELAY AND DIFFERENCE VOLTAGE SETTINGS
Both Sources at 120 volts

TESTING

1. MAINTENANCE AND RENEWAL PARTS

No routine maintenance is required on these relays. 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 will be provided on request. Renewal parts will be quoted by the factory on request.

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

224J/224K 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 a 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 or inserting the board with the unit in service may cause an incorrect operation.*

An 18 point extender board, catalog 200X0018, is available for use in troubleshooting and calibration of the relay.

See page 10 for information on units of catalog series 224S/224V, which are obsolete.

424J/424K Series Units:

Metal handles provide leverage to withdraw the relay assembly from the case. Removing or installing the relay while energized may result in an incorrect operation, depending how the output contacts are used in the scheme.

The assembly is identified by the catalog number stamped on the front panel and a serial number stamped on the bottom of the circuit board.

Test connections are 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.

Test Plug:
A test plug assembly, catalog number 400X0002, is available for use with the 424 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 its case sufficient to break the rear connections before applying the test voltage.

3. BUILT-IN TEST FUNCTION

For the Types 25S and 25V relays, the built-in test can be run only with both sources to the relay energized and in synchronism. BE SURE TO TAKE ALL NECESSARY PRECAUTIONS

When the TRIP TEST button is depressed, a signal representing a loss of synchronism is injected into the circuitry. If the PICKUP indicating light was "on" before the test button was depressed, it should turn "off" indicating a loss of synchronism. At the same time, the TIMER indicator should go out and the relay contacts should return to their de-energized position.

Presuming the Bus and Line sources have remained in synchronism, when the TEST button is released the PICKUP indicating light should come on. After the time set on the TIME DELAY dial has expired, the TIMER indicating light should come on and the relay contacts should transfer to the picked-up state.

4. ACCEPTANCE TESTS

A typical test circuit for these tests is shown in Figure 5.

Tests "A" and "B" apply only to the Type 25V. For Type 25S, skip to Test "C".

A. LINE AND BUS LEVEL ADJUSTMENTS:

1. Set DIFFERENCE VOLTS dial to fully counterclockwise (minimum) position.
2. Set TIME DELAY dial to minimum time.
3. Set FUNCTION switch to HBDL. Close switches S1, S2, S3.
4. Adjust autotransformer T1 so that V2 equals the desired "LIVE LINE" voltage. (Use 30 volts if a particular voltage level has not been specified for the application.)
5. With a small screwdriver, turn the LINE level adjustment on the front panel until the PICKUP indicating light goes off. Then turn the adjustment in the opposite direction until the PICKUP light just comes on. The LIVE LINE level is now set.
6. Refer to Figure 5. Open switch S1. Interchange the BUS and LINE voltage input connections to the relay, so that T1 now controls the BUS voltage input.
7. Turn the FUNCTION switch to HLDB. Close switch S1.
8. Repeat the process (steps 4,5,6), using the BUS level adjustment to set the LIVE BUS voltage level.
9. *Return the test connections to the original arrangement per Figure 5.*

B. FUNCTION SWITCH SETTING TESTS:

1. Set DIFFERENCE VOLTAGE and TIME DELAY dials to their minimum positions.
2. Referring to Figure 5, close switches S1, S2, S3.
3. Adjust autotransformer T1 so that voltages V1 and V2 are equal.
4. Check the FUNCTION switch on the front panel in each of its four positions in sequence from left to right. The relay should pick up or drop out as shown in the table below when S2 and S3 are in the positions indicated.

	FUNCTION SWITCH POSITION	RELAY SHOULD PICK UP	RELAY SHOULD DROP OUT
S2 Closed S3 Open	Sync Check Only		X
	HBDL	X	
	HLDB		X
	HBDL or HLDB	X	
S2 Open S3 Closed	Sync Check Only		X
	HBDL		X
	HLDB	X	
	HBDL or HLDB	X	

C. PICKUP TEST:

To check the set value of the vector DIFFERENCE VOLTAGE, proceed as follows:

1. Set the DIFFERENCE VOLTAGE dial to 40 volts. Set TIME DELAY dial to minimum. If the relay is Type 25V, set the FUNCTION switch to SYNC CHECK ONLY.
2. Referring to the test ciruit in Figure 5, close switches S1, S2, and S3.
3. Adjust autotransformer T1 until voltages V1 and V2 are equal. The PICKUP indicator light should be on.
4. Reduce V2 by adjusting T1 until the PICKUP indicator goes out.
5. Slowly increase V2 until the PICKUP indicator just turns on. The DIFFERENCE VOLTAGE is V3. For the 40 volt setting the value should be between 36 and 44 volts.
6. If the particular DIFFERENCE VOLTAGE setting for the application has been determined, it should be set on the dial and verified by repeating steps 2 through 5.

D. TIME DELAY TEST:

1. Set the TIME DELAY dial to 1.0. Note that the expected time delay is the dial setting times the rating stamped on the front panel at the lower left side. If the relay is Type 25V, set the FUNCTION switch to SYNC CHECK ONLY.
2. Referring to Figure 5, close switches S1, S2, S3.
3. Adjust autotransformer T1 until voltages V1 and V2 are equal.
4. Open switch S3. PICKUP and TIMER indicators should be off.
5. Reset the external timer. Close S3. External timer should start, and then stop when the relay contacts transfer. Both indicators on the Type 25 relay should be on. Read the elapsed time on the external timer.
6. The elapsed time should be between 9 and 11 seconds for relays rated 10 seconds, and between 0.9 and 1.1 seconds for relays rated 1 second.
7. If the particular time delay setting for the application has been determined, it should be set on the TIME DELAY dial, and verified by repeating steps 2 through 5.

5. INTERNAL CALIBRATION POTENTIOMETERS

Internal potentiometers are used to calibrate the front panel dials: R18 is used to calibrate the DIFFERENCE VOLTAGE dial, and R44 is used to calibrate the TIME DELAY dial. These are factory settings that usually will not have to be readjusted.

6. OBSOLETE UNITS - CATALOG SERIES 224S/224V

Units of the 224S/224V catalog series are functionally equivilent to the 224J/224K series, but did not include the led indicators. Drawout circuit boards of this series are not interchangible with boards of the 224J/224K series.

Case dimensions and rear terminal wiring are identical for all three series units; therefore, if replacement of a 224S or 224V unit is necessary we recommend replacing the entire unit with the equivilent 424 series unit:

Type	Catalog Number	Recommended Replacement
25S	224S1105	424J1105
25S	224S2105	424J2105
25V	224V1105	424K1105
25V	224V2105	424K2105

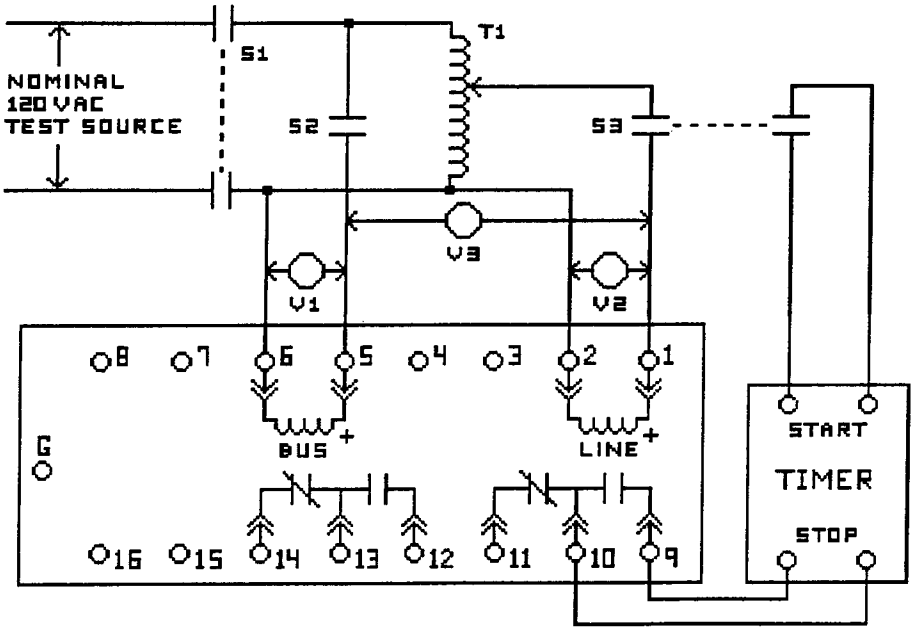

FIGURE 5: TEST CIRCUIT CONNECTIONS

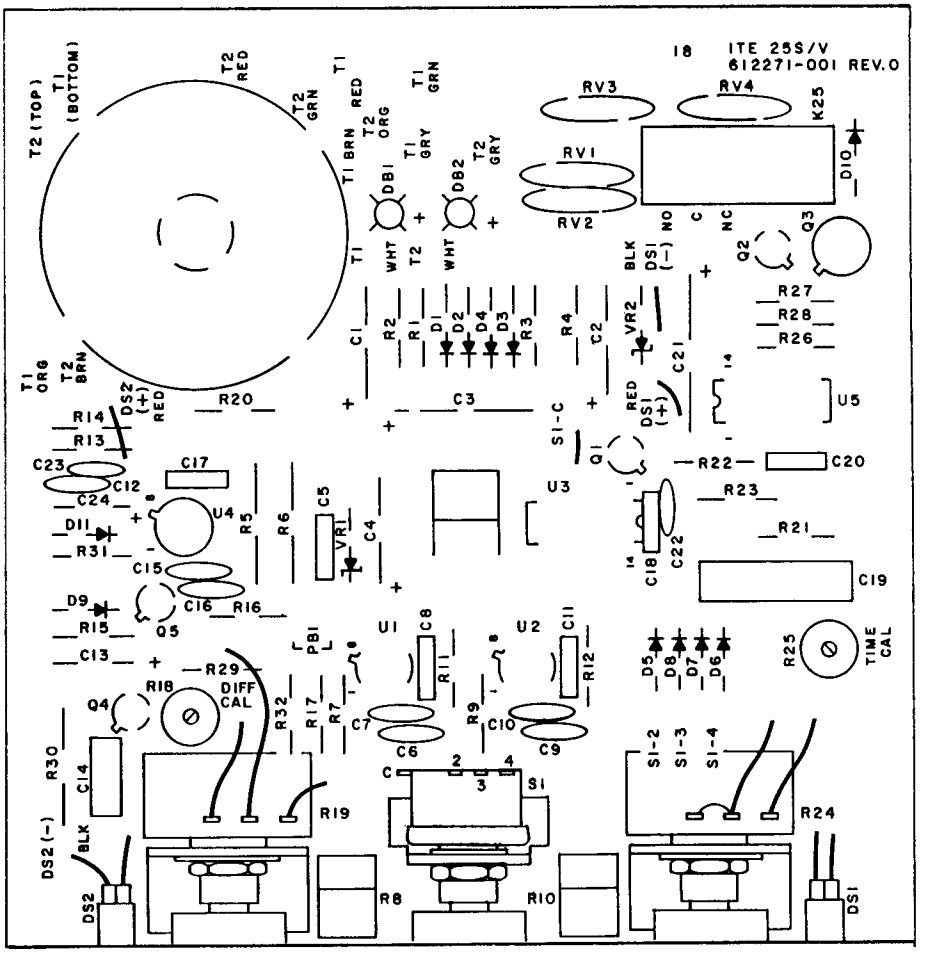

FIGURE 6: TYPICAL CIRCUIT BOARD LAYOUT