DESCRIPTION OF CONTROLS AND INSTRUMENTATION

CONTROL SECTION

The Control Section of Model SR-76A comprises two output channels of the test set; one is controlled by the large AC control knob and the other is controlled by the smaller DC or VERNIER knob. The following is a description of the controls and instrumentation in the control section.

Input Line Cord	The test set is equipped with a standard line cord which is permanently mounted through the panel. A bracket is mounted in the lid for easy storage of the line cord. The nameplate should be checked for verification of input voltage before connecting the line cord to the source of power.
POWER ON/OFF Switch	Functions as main input switch for the test set.
POWER ON Light	Indicates when the POWER ON/OF Switch is in the ON position and that input power to the test set is available.
INITIATE Button	The INITIATE button serves to start operation of the test set. An internal light indicates whenever the test set is initiated. NOTE: Refer to the "NOTE" in the INITIATE CONTROL circuit section for discussion on use of INITIATE button.
EXT. INITIATE Jack	The test set can be initiated from a remote location by closing a circuit plugged into the EXT. INITIATE jack.
RELAY CONTACTS Binding Posts	Binding posts where the trip circuit contacts of electromechanical relays or solid state relays not utilizing an SCR are connected.
S.C.R TRIP Binding Posts (Red +, Black -)	Binding posts where the SCR trip circuit of solid state relays is connected.

WARNING

Care must be exercised to avoid applying potential to the RELAY CONTACTS OR SCR TRIP binding posts. Applying potential can result in damage to the timer, as well as damaging the tone generator circuit.

TONE/CONTINUITY Switch	A CONTINUITY light or TONE generator can be used to monitor contact action or circuit continuity, when the INITIATE CONTROL lever is in the CONTINUITY position. When the TONE generator is used, the CONTINUITY light does not operate.

CONTINUITY Light	A low voltage circuit is used to monitor contact action or circuit continuity.
Timer	Used to measure the elapsed time of operation of the device under test. The Timer is equipped with a CYCLES/SECONDS Switch for selection of counting mode as well as a switch for use in selection of the range when in the seconds mode. Additionally, a RESET button is provided to reset the timer initiate circuitry and display.

INITIATE CONTROL Circuit:
The control circuit of model SR-76A provides facilities for observing contact action by use of a CONTINUITY light or a TONE generator, as well as for the timing of devices with normally open (NO) or normally closed (NC) contacts, or with an SCR trip circuit. Operation of the control circuit is determined by the INITIATE CONTROL Switch, which is divided into two sections...knob and lever. A description of each section follows:

Lever Section

In order to eliminate changing test leads, this switch connects the RELAY CONTACTS binding posts to three different circuits. A relay's trip circuit can be connected and by simply using this switch, its contact action can be monitored, the timer can be stopped, or DC can be applied to the target and seal-in unit.

D.C.: In this position, the RELAY CONTACTS binding posts are connected in parallel with the 0-5A D.C. output binding posts. The D.C. output can be used to test the relay's target and seal-in unit.

The Knob Section of the switch must be in either the N.O. MOM. or N.O. MAINT. position in order to obtain a D.C. output. The timer will not run and closure of the contacts of the device under test will not de-energize the test set.

CONT: In this position the RELAY CONTACTS binding posts are connected to the continuity circuit. Therefore, contact action can be observed by the continuity light or by the tone generator.

TIMER: In this position, the RELAY CONTACTS binding posts or SCR TRIP binding posts are used in conjunction with the Knob Section of the switch to control the operation of the digital timer.

NOTE: When the lever is in the TIMER position, it is necessary to reset the digital timer by depressing the RESET button on the timer before the test set can be INITIATED. Therefore, should the test set fail to INITIATE upon depressing the INITIATE button, reset the timer and then re-initiate. If the timer still fails to INITIATE, check the NORMAL/DROPOUT Switch which is located in the auxiliary section and make sure it is in the NORMAL position. When

the lever is in either the CONT. or D.C. position, it is normally not necessary to depress the RESET button to re-initiate the test set; however, occasionally, it may be necessary.

Knob Section

N.O. MOM. (Normally Open Momentary):

When the device under test has normally open contacts which are connected to the RELAY CONTACTS terminals, the outputs of the test set are energized by depressing the INITIATE button. The selected outputs will remain energized as long as the INITIATE button is held depressed or, if the Lever Section is in the TIMER position, until the contacts of the device under test close.

N.O. MAINT. (Normally Open Maintained):

The function of this position is exactly the same as above except that the INITIATE button only needs to be depressed momentarily to lock-in a circuit which maintains the output of the test set. If the Lever Section is in the TIMER position, the timer will stop and the output of the test set will de-energize upon contact closure of the device under test.

NC.C. MOM. (Normally Closed Momentary):

When the device under test has normally closed contacts which are connected to the RELAY CONTACTS terminals, the outputs of the test set are energized by depressing the INITIATE button. The selected outputs will remain energized as long as the INITIATE button is held depressed or, if the Lever Section is in the TIMER position, until the contacts of the device under test open.

N.C. MAINT. (Normally Closed Maintained):

The function of this position is exactly the same as the N.C. MOM. position except that the initiate button only needs to be depressed momentarily to lock-in a circuit which maintains the output of the test set. If the Lever Section is in the TIMER position, the timer will stop and the output of the test set will de-energize when the contacts of the device under test open.

0-A.C. Control Knob

This knob controls the main A.C. output of the test set.

A.C. Output Terminals	The output controlled by the main A.C. control knob is available at the terminals located at the bottom of the Control Section. There is one common terminal and five output ranges. Each range can be used either as source of AC voltage or AC current. Each range is capable of supplying the indicated current, provided the voltage is sufficient to push the current through the impedance of the load circuit. Where the voltage is sufficient to "push" higher than rated current through the impedance of the load circuit, the current ratings are designed to be overloaded for short durations. For overload capabilities, refer to the OVERLOAD CAPABILITY OF THE MAIN AC OUTPUT section of this manual.
A.C. AMPERES Ammeter:	Measures the AC output current. The meter is equipped with an adjustable "pointer preset mechanism" which is used to aid in measuring currents of short duration.
A.C. AMMETER RANGE Switch	Selects full scale range of the AC ammeter. Always use the lowest range which will not over-range the meter.
EXT. USE A.C. AMMETER Terminals	These two terminals enable the ammeter to be used in conjunction with the A.C. Ammeter and A.C. AMMETER RANGE Switch to measure external currents up to 250 amperes. When using the ammeter to measure external currents, connect the EXT. USE AMMETER terminals in series with the current to be measured and select the appropriate range on the A.C. AMMETER RANGE Switch.
D.C. AMPERES Ammeter	Measures the D.C. output current.
D.C. AMMETER RANGE Switch	Selects full scale range of the D.C. ammeter.
D.C. VERNIER CONTROL Knob and D.C./VERNIER Switch	When the DC/VERNIER Switch is in the D.C. position, this knob controls the D.C. CURRENT output. When in the VERNIER position, it is a fine-adjustment for the main A.C. output.
0-5A D.C. OUTPUT Binding Posts (Red +, Black -)	Binding posts for the D.C. current output. These binding posts are in parallel with the relay CONTACTS binding posts when the INITIATE CONTROL Lever is in the D.C. position and therefore, D.C. current can be obtained from either set of binding posts.
120V SYNC. Binding Posts	These terminals are energized with 120 volts whenever the unit is initiated. This voltage may be used as a control source to initiate an external device such as an auxiliary relay.

P.A.M. Jack	This jack is in series with the five-ampere secondary of the AC ammeter current transformer. It is used to connect external instrumentation such as the current coil of a phase angle meter. The current in the PAM circuit is 0-5 amperes, as long as the ammeter is not over-ranged.
HARMONIC RESTRAINT/NORMAL Switch	In the NORMAL position, the harmonic restraint circuitry is completely isolated in the test set. When switched to the HARMONIC RESTRAINT position, the 0-25A Output (Blue) Binding Post in the AUX. SECTION will provide the necessary half-wave rectified output for testing the harmonic restraint element in harmonic restraint differential relays. The output is controlled by the large 0-25A/0-300V control knob in the AUX. SECTION. The magnitude of D.C. output can be read on the D.C. Ammeter in the CONTROL SECTION, next to the HARMONIC RESTRAINT/NORMAL Switch.

Fuses (all dual element, slow-blow fuses)

F1, 1.5A	Protects Digital Timer Circuit and Initiate Circuit.
F2, 15A (7.5A for 240-volt units)	Provides overload and short-circuit protection for the input of the test set.
F3, 15A	Provides overload and short-circuit protection for the main AC output circuit.
F4, 2.5A	Protects DC/VERNIER output circuit.

AUXILIARY SECTION

The Auxiliary Section of Model SR-76A comprises two output channels on the test set; one controlled by the large knob and the other by the small knob. The following is a description of the various controls and instrumentation in the Auxiliary Section.

POWER ON INDICATOR	A Yellow lamp indicates when input power is available to the Auxiliary Section.
AC AMPERES Ammeter	Measures the magnitude of the 0-25 ampere current output available at the Blue and White output binding posts. The meter is equipped with a pointer preset mechanism to facilitate measuring currents of short durations.
A.C. AMMETER RANGE Switch	Selects full scale range of the AC ammeter. Always use the lowest range which will not over-range the meter.
0-25A/0-300V AC Switch, Control Knob and Output Binding Posts	The switch is used to select whether a current output of 0-25 amperes at 40 volts or a potential output of 0-300 volts at 0.5 amperes is available at the Blue and White output binding posts labeled 0-25A or 0-300V AC. The White binding post is the instantaneous (±) polarity binding post.
AUXILIARY OUTPUTS Selector Switch, Control Knob and Output Binding Posts	The AUXILIARY OUTPUTS Switch is used to select one of four output potentials or one of three special test circuits. The magnitude of the selected output is controlled by the AUXILIARY OUTPUTS knob (small knob). A description of each of the seven AUXILIARY OUTPUTS follows:
0-150V DC:	0-150V DC @ 1.0 amperes is available at the Red (+) and Black (-) binding posts.
0-300V DC:	0-300V DC @ 0.5 amperes is available at the Red (+) and Black (-) binding posts.
0-150V AC:	0-150V AC @ 1.0 amperes is available at the Red and Black binding posts. The Black binding post is the (±) instantaneous polarity binding post.
0-300V AC:	0-300V AC @ 0.5 amperes is available at the Red and Black binding posts. The Black binding post is the (±) instantaneous polarity binding post.
V.RLY.:	In conjunction with the V. RLY/DET. Switch and the 0-25A or 0-300V AC control knob, a special test circuit is provided for testing over and under-voltage relays. For further details, refer to the description of the V. RLY/DET. Switch.

DET.: In conjunction with the V. RLY/DET. Switch and the 0-25A or 0-300V AC control knob, a special test circuit provides a voltage and current exactly in or out of phase for testing directional elements. For further details, refer to the description of the V. RLY/DET. Switch.

I. RES.: 0-500 volts DC for measuring insulation resistance. The output is available at the small Red and Black pin sockets labeled I. RES. and is controlled by the AUXILIARY OUTPUTS knob. For further details, refer to the description of I. RES. SET/TEST Switch.

AC/DC Voltmeter — Used in conjunction with the VOLTMETER CIRCUIT SELECTOR Switch and the VOLTMETER RANGE Switch and the magnitude of the various potential outputs of the test set or of an external AC or DC potential.

VOLTMETER RANGE Switch — Selects the full scale range of the AC/DC voltmeter. Always use the lowest range which will not over-range the meter.

VOLTMETER CIRCUIT SELECTOR Switch — Used to select the circuit whose potential is to be measured by the AC/DC VOLTMETER. A description of each position follows:

300V AC: Measures the 0-300V AC output of the Auxiliary Section

AUX. A.C.: Measures either the 0-150V AC or the 0-300V AC output, whichever is selected by the AUXILIARY OUTPUTS Switch.

AUX. D.C.: Measures either the 0-150V DC or the 0-300V DC output, whichever is selected by the AUXILIARY OUTPUTS Switch.

V. RLY: Measures the outputs of the voltage relay test circuit.

DET.: Measures the potential output of the directional element test circuit.

I. RES.: Measures insulation resistance in conjunction with the insulation resistance test circuit.

EXT. AC: Used to measure an external AC potential applied to the Red and Black binding posts located next to the VOLTMETER CIRCUIT SELECTOR Switch.

EXT. DC: Used to measure an external DC potential applied to the Red (+) and Black (-) binding posts located next to the VOLTMETER CIRCUIT SELECTOR Switch.

V. RLY/DET. Switch

Used in conjunction with the voltage relay and directional element test circuits. The functions of each position are as follows:

V. RLY. NORM: Used to apply the normal relay voltage to the voltage relay under test. The output is available at the AUXILIARY OUTPUTS Red and Black binding posts and is controlled by the 0-25A or 0-300V AC knob.

V. RLY. FAULT: Used to preset the fault voltage to be applied to voltage relay under test. When in this position, the normal voltage set in the V. RLY. NORM. position remains on the relay. The magnitude of the fault voltage is controlled by the AUXILIARY OUTPUTS knob.

V. RLY. TEST: The fault voltage which was preset in the V. RLY. FAULT position is applied to the relay and the digital timer is simultaneously started. When the relay operates, the timer will stop.

DET. positions: Four ranges are provided to conduct pickup tests on directional elements. To obtain a voltage and a current exactly in phase, the instantaneous polarity terminal of the relay's current coil is connected to the Blue 0-25A or 0-300V AC binding post. The non-polarity terminal is connected to the Black AUXILIARY OUTPUTS binding post. The instantaneous polarity terminal of the relay's potential coil is connected to the Black AUXILIARY OUTPUTS binding post and the non-polarity terminal is connected to the Red AUXILIARY OUTPUTS binding post.

The magnitude of the voltage and current is controlled by the 0-25A or 0-300V AC knob.

Reversing either the current coil or the potential coil connections will result in the current and potential being 180° out of phase.

NORMAL/DROPOUT Switch

Used to perform a dropout timing test on an AC or DC auxiliary relay. When the switch is changed from the NORMAL to the DROPOUT position, the relay under test is de-energized and the digital timer is simultaneously started.

NOTE: When the Control Section and the Auxiliary Section are interconnected, the NORMAL/DROPOUT Switch must be in the NORMAL position in order to start the timer by depressing the INITIATE pushbutton. If the NORMAL/DROPOUT Switch is inadvertently left in the DROPOUT position,

the timer will not start. The operator should make sure the switch is left in the NORMAL position except when running a dropout test.

NORMAL/EXT. Power Input Switch and Binding Posts	Selects whether the AUXILIARY OUTPUTS variable autotransformer is energized from an internal (NORMAL) or an external source. When it is desirable to energize from an external source of power (not over 120 volts AC) such as a phase shifter or frequency generator, the source is connected to the Yellow and White (±) binding posts. The potential is then controlled by the AUXILIARY OUTPUTS knob.
I. RES. SET/TEST Switch and Output Pins	Used in conjunction with the AUXILIARY OUTPUTS Selector Switch and Control Knob, the AC/DC voltmeter, VOLTMETER CIRCUIT SELECTOR Switch and the VOLTMETER RANGE Switch for measuring insulation resistance. The AUXILIARY OUTPUTS control knob is used to calibrate the megohm range on the AC/DC voltmeter to the infinity calibration mark with the SET/TEST Switch in the SET position. In the TEST position, 500 volts DC is applied and the insulation resistance is indicated on the AC/DC voltmeter. The output is available at the Red (+) and Black (-) output pins.
I. RES. TEST Lamp	Indicates whenever the I. RES. test circuit is energized.
INITIATE NORM/BYPASS Switch	This switch is used in conjunction with the AUX. OUTPUT in order to obtain a DC voltage without initiating the test set. When in the NORM position, output cannot be obtained from the AUX. OUTPUT until the INITIATE Switch is initiated. When in the BYPASS position an AC or DC voltage up to 300 volts can be obtained from the AUX. OUTPUT without having to initiate the test set.

Fuses (all dual element, slow blow fuses)

F6, 5A	Protects the 0-25 or 0-300V AC output circuit
F7, 1.5A	Protects the 0-300V AC output transformer
F8, 1.5A	Protects the AUXILIARY OUTPUTS circuit