INSTRUCTION MANUAL

For

SECONDARY INJECTION TEST SET

Model SITS-120

It is essential that this instruction book be read thoroughly before putting the equipment in service.

Part _50377
Date 04/27/1998

REVISION HISTORY

Revision	ECN #	Date
0		04/27/1998

COMMENTS

Any comments or suggestions regarding the use of this test instrument or instruction manual would be appreciated. Send your comments to AVO International, 4271 Bronze Way, Dallas, TX 75237

IMPORTANT

The information and data contained within this instruction manual are proprietary with AVO International. The equipment described herein may be protected by one or more U.S. letters patent. AVO INTERNATIONAL specifically reserves to itself all rights to such proprietary information as well as all rights under any such patent, none of which is waived by the submission of this instruction manual to anyone.

The recipient, if a Government agency, acknowledges that this instruction book and the equipment described were procured with "Limited Rights" to technical data as described in ASPR 9-203 (b).

SAFETY PRECAUTIONS

WARNING:
VOLTAGES GENERATED BY THIS INSTRUMENT CAN BE HAZARDOUS

This instrument has been designed for operator safety; however, no design can completely protect against incorrect use. Electrical circuits are dangerous and can be lethal when lack of caution and poor safety practices are used. There are several standard safety precautions that should be taken by the operator. Where applicable, IEC safety markings have been placed on the instrument to notify the operator to refer to the instruction manual for instructions on safety related topics. Refer to the following table of symbols and definitions.

Symbol	Description
	Direct Current
	Alternating Current
	Both direct and alternating current
	Earth (ground) Terminal. The SITS-120 output Ground terminals are connected to chassis ground.
	Protective Conductor Terminal
	Frame or Chassis Terminal
	On (Supply)
	Off (Supply)
	Caution, risk of electric shock
	Caution (refer to accompanying documents)

The following are some specific safety related items associated with the SITS-120 test system.

Always start with the power OFF, before connecting the power cord. Make sure outputs are off before attempting to make test connections.

Always use properly insulated test leads. The test leads supplied with the unit are rated for the voltage output ratings of the test system, and should be properly used and cared for. Do not use cracked or broken test leads.

Always lift and carry the test set using both carry handles. Improperly carrying the unit by one handle could damage the handle.

Always turn the test system off before disconnecting the power cord. Turn outputs off before removing or inserting test leads.

UNDER NO CIRCUMSTANCES SHOULD THE OPERATOR PUT HIS HANDS OR TOOLS INSIDE THE TEST SYSTEM CHASSIS WITH THE TEST SYSTEM CONNECTED TO A POWER SOURCE. LETHAL VOLTAGES ARE PRESENT AND MAY CAUSE SERIOUS INJURY OR DEATH!

INSTALLATION Category II

OPERATIONAL SAFETY

Every consideration has been given to the design and construction of the Secondary Injection Test Set to make it a safe piece of test equipment as well as one that is accurate, reliable and easy to use.

It must be remembered that the unit is capable of producing voltage and current levels that can be deadly if personnel come in contact with them.

The SITS-120 unit should be properly operated and serviced by qualified individuals who have familiarized themselves with the unit and thoroughly read the instruction manual provided with it.

If questions arise concerning care, operation or application of the unit that are not explained in the instruction manual, contact a AVO INTERNATIONAL representative.

TABLE OF CONTENTS

SECTION **PAGE**

OPERATIONAL SAFETY....ii

THEORY OF OPERATION....1

UNIT PANEL ILLUSTRATION....1

DESCRIPTION OF CONTROLS AND INSRUMENTATION....2

INPUT POWER....6

SELECTION OF OUTPUT TERMINALS....7

SERVICE DATA....8
- MAINTENANCE INSTRUCTIONS....8

BASIC TROUBLESHOOTING....9
- Power Input....9
- Timer, Monitor and Battery Simulator Module....10
- WARRANTY....13

TEST APPLICATIONS....14

TEST PROCEDURES....14
- TIME DELAY OVERCURRENT DEVICES....14
- INSTANTANEOUS ELEMENT OF OVERCURRENT RELAYS....16
- TIME DELAY VOLTAGE RELAYS....18
- PICKUP and DROPOUT TEST PROCEDURE FOR VOLTAGE CONTROLLED RELAYS....19
- GENERAL TEST FOR TIMING OPERATIONS....20
- MOLDED CASE CIRCUIT BREAKERS....21
- OVERCURRENT ELEMENT OF CIRCUIT BREAKERS....22
- INSTANTANEOUS ELEMENT OF CIRCUIT BREAKER....24
- MOTOR OVERLOAD RELAYS....26

SPECIFICATIONS....27

OPTIONS AND ACCESSORIES....30

PARTS LIST....31

SCHEMATICS....32

THEORY OF OPERATION

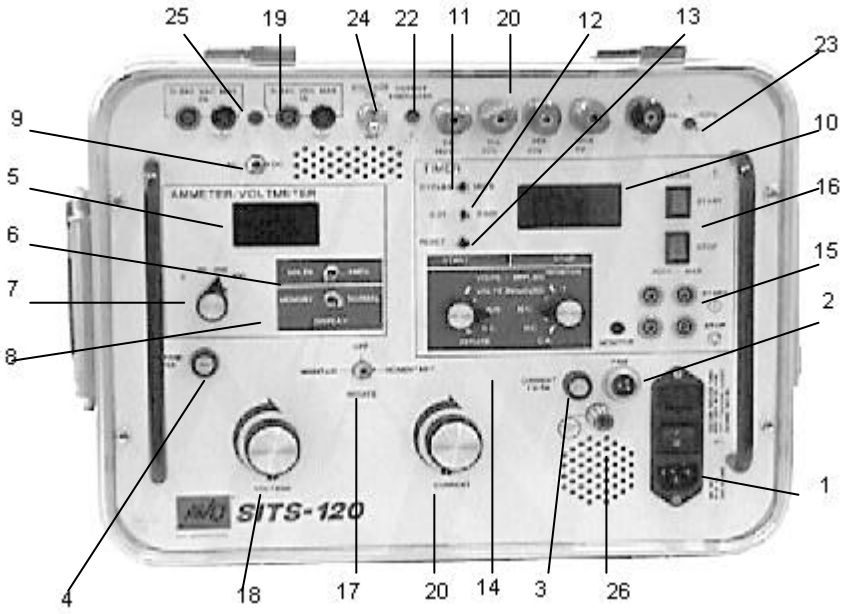
The AVO Secondary Injection Test Set is a portable, self-contained unit which provide stepless, continuously adjustable current and voltage outputs.

The unit is housed in a rugged, compact suitcase-type thermoplastic enclosure with convenient carry handles and removable cover.

The SITS-120 unit incorporates digital metering, crystal-controlled digital timer, and solid-state control circuitry to provide a variety of independently adjustable voltage and current outputs. The dual purpose volt/ammeter will provide a wide variety of accurate, switch-selectable ranges.

The independent outputs enable the SITS-120 to provide current or voltage only, or a combination of the two, to meet numerous testing requirements in a wide variety of test applications. The main AC current output has selectable output ranges of 5 Amperes @ 0 - 140 Volts; 10 Amperes @ 0 - 70 Volts; 25 Amperes @ 0 - 40 Volts and 120 Amperes @ 0 - 5 Volts. The voltage outputs are switch selectable, either AC or DC, with a range of 0 - 240 Volts.

UNIT PANEL ILLUSTRATION



DESCRIPTION OF CONTROLS AND INSTRUMENTATION DESCRIPTION OF FEATURES

POWER ON/OFF Switch and Input Power Connection (1):
The switch controls all the input power to the unit, but no output is available until the unit is initiated. Power on is indicated by the meter displays which light up when the unit is energized. The input connector is a standard IEC connector. See Input Power for description of power input and power cord selection.

PAM Output Terminal (2):
This output terminal provides a 10 to 30 Volts AC output to a voltage coil of a phase angle meter. It should be noted that the voltage output is in-phase with the SITS-120 main AC current output. **DO NOT** apply this voltage output to the current coil of a Phase Angle Meter. Optional interface cable available for PVO phase shifters, see Optional Accessories in Specifications.

CURRENT Output **FUSE** (F2) (3):
Protects the current output portion of the test set. If this fuse is blown, the unit will operate but no current will be present at the current output binding posts. Fuse should be replaced with appropriate size, slow-blow, T rated fuses (see accessory list).

VOLTAGE Output **FUSE** (F1) (4):
Protects the voltage output portion of the test set. If this fuse is blown, the unit will operate but no voltage will be present at the voltage output terminals. Fuse should be replaced with appropriate size, slow-blow, T rated fuses (see accessory list).

AMMETER/VOLTMETER (5):
The meter reads either current or voltage over a wide range. LED display shows the numeral one in the left-most digit when meter is over-ranged.

VOLTS/AMPS Selector Switch(6):
The meter will read either voltage or current depending on the position of this switch. The meter may be switched back and forth during a testing operation to monitor both outputs when they are being used simultaneously. However, both outputs must be above threshold level of range selected.

Range Switch (7):
Decimal shifts one digit to the right for each increase in range selection. The 300 range will read beyond 300 if conditions permit the unit to produce that much output.

DISPLAY Mode Switch (8):
NORMAL or **MEMORY** mode can be selected as desired. Moving this switch during meter operation will not interfere with unit functions or meter accuracy.

> **MEMORY**:
> Retains highest reading of peak current attained during output operation above 8% of full scale of range selected. Reading is retained until unit is reinitiated, **Range Switch** position is changed, or **VOLTS/AMPS** selector is switched.

NORMAL:
Updates voltage and current readings continually as long as output is energized above threshold level. Reading is lost when output is de-energized or drops below threshold level. NOTE: Threshold level of highest meter range is not based on a percentage of the range indicated.

AC, DC Selector Switch (9):
Used to select either an AC or DC voltage output from the Voltage Output Terminals, controlled by the **VOLTAGE** Output Control Knob.

TIMER (10):
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 either a 0.01 seconds, 0. 001 seconds or a cycles counting mode. Additionally, the **RESET** button is provided to reset the Timer initiate circuitry and display. Reads cycles and seconds with a variety of operating modes.

Display Mode Switch (11): Selects either cycles or seconds.

Seconds Scale Switch (12): Readings to two or three decimal places can be selected.

CYCLES: Reads in cycles.
SEC'S: Reads in two scales of seconds.

NOTE: Changing display mode or scale during timer operation will produce erroneous readings.

TIMER RESET Button (13):
Used to reset the TIMER. Pressing this button will reset the Timer to all zeros. Should the test set fail to initiate upon pressing the INITIATE switch, RESET the Timer and then re-initiate. If the Timer STOP LATCH is ON, it will be necessary to RESET the Timer after an external operation of a contact closure of the device under test. If it is desired to repeatedly operate the unit in the MOMENTARY Mode, without resetting the Timer, switch the STOP LATCH OFF.

START/STOP Selector Switches (14):
Two independent five-position selector switches are provided for selection of the Start and Stop/Monitor Gates. The left switch is used to select the Start gate operating mode, while the right switch is used to select the Stop mode. In addition, the **STOP** Switch is also used in conjunction with the **MONITOR** lamp for selecting the desired Monitor mode of operation. The following modes are provided for the **START** and **STOP/MONITOR** gates:

VOLTS APPL'D (Voltage Applied):
The function of this position is to monitor the application of an AC/DC voltage across the trip output of the device under test. The Timer starts or stops when an AC potential (60 - 300 Volts RMS) or DC potential (5 - 300 Volts) is applied. Note, CAT II insulated test leads required (use PN 1282 leads).

VOLTS RMV'D (Voltage Removed):
The function of this position is to monitor the removal of an AC/DC voltage across the trip output of the device under test. The Timer starts or stops when an AC potential (60 - 300 Volts RMS) or DC potential (5 - 300 Volts) is removed. Note, CAT II insulated test leads required (use PN 1282 leads).

N.O. (Normally Open):
The function of this position is to monitor normally open dry contacts of the device under test. The Timer starts or stops at the closing of a normally open dry contact.

N.C. (Normally Closed):
The function of this position is to monitor normally closed dry contacts of the device under test. The Timer starts or stops at the opening of a normally closed dry contact.

INITIATE:
When the **START** Switch is in this position, the Timer will start when the output is initiated using the **INITIATE** Switch. NOTE: A threshold current of approximately 8% of range, must be exceeded for the Timer to start.

C.A. (Current Actuate):
The Timer stops when the output current is interrupted by the device under test. The **C.A.** position is used when the device under test has no contacts other than those used to pass current (such as a single-pole circuit breaker).
NOTE: Timer START LATCH must be OFF and output must be maintained above threshold level or timer error will result.

START/STOP/MONITOR Terminals (15):
Two identical, independent, Start, Stop/Monitor Terminals are provided to monitor operation of relay contacts or trip SCR's. A **MONITOR** light is provided with the **STOP** Terminals. The **MONITOR** lamp will glow when the condition set with the **STOP** Selector Switch is met.

LATCH ON/OFF Switches (16):
These switches are used in conjunction with the **START/STOP** Switches and the **START/STOP** Terminals to supervise the starting and stopping of the Timer.

START LATCH:
The Timer **START LATCH ON** allows timing to be initiated by a Start Gate and to be stopped only by the selected Stop Gate. When unlatched, **LATCH OFF**, allows timing to be stopped when the Start Gate is reversed (such as when timing the closing and opening of a single contact as in measuring the trip-free operating time of a circuit breaker).

STOP LATCH:
When the **STOP** circuit is latched **ON**, the stop latch allows timing to be stopped at the first operation of any selected stop gate. When the **STOP** circuit is latched **OFF**, the stop latch allows timing to be stopped by any stop gate and then restarted if the stop gate reverses (provided a start gate is still energized) and stopped when the stop gate is again true. NOTE: When using the **MONITOR** feature, the **STOP LATCH** must be **OFF**.

INITIATE Switch (17):
The **INITIATE** Switch serves to start operation of the test set. An **OUTPUT ENERGIZED** lamp will light when the unit is energized.

OFF:
Unit remains powered up but both outputs are de-energized and timer will not run.

MOMENTARY:
Momentary "ON" position with spring return to center **OFF**. Output will remain energized as long as switch is held in **MOMENTARY** position and is de-energized when released. Timer will start with the initiation of the output, when the **START** Gate selector switch is in the **INITIATE** mode. Used for "jogging" output circuit. If the output does not initiate, press the **TIMER RESET** button and make sure the **STOP LATCH** is **OFF**.

MAINTAIN:
Energizes output circuit when moved to **MAINTAIN** position. Output will remain energized until appropriate **STOP** Mode function occurs, switch is moved to **OFF** or output drops below threshold requirement of control circuitry.

VOLTAGE Output Control Knob (18):
Provides continuous control, variable, non-stepped voltage output. Voltage output, AC or DC, depends on the **AC/DC** selector switch (9) below the voltage output terminals.

Voltage Output Terminals (19):
These two sets of output terminals are used to provide voltage to the device under test. The output depends on the **AC/DC** selector switch (9) located directly below the output terminals. The output is controlled by the **VOLTAGE** Output Control Knob (18).

0 - 240 VAC MAX: Up to 240 Volts AC is available from these terminals.

0 - 240 VDC MAX : Up to 240 Volts DC is available from these terminals.

CURRENT Output Control Knob (20):
Controls autotransformer to provide continuous, variable, non-stepped current output.

Current Output Binding Posts (21):
In conjunction with the common tap, four current rated output binding posts are provided to supply a variety of currents at various voltage levels. They are not polarity sensitive.

WARNING: Do not use more than one current-rated tap at a time and only in conjunction with the common tap, never with each other.

NOTE: The current designation of these terminals has no bearing on the actual current output of each. Much higher currents can be achieved depending on circuit impedance and duration of the test.

OUTPUT ENERGIZED Lamp (22):
Lights up whenever the current outputs are energized.

Frequency Set Switch (23):
Set switch to the appropriate position depending on input power frequency. Set to **50 HZ** if input source is 50 HZ, set to **60 HZ** for 60 HZ input source. Check to insure that the Frequency Set Switch is set to the proper input frequency prior to use. Failure to properly set switch may result in timing errors.

Voltage ON/INITIATE Switch (24):
The Voltage ON/INITIATE Switch switches on the AC/DC voltage outputs if in the ON position. While in the ON position, the outputs stay on regardless of the INITIATE Switch (17). When the Voltage ON/INITIATE Switch is in the INITIATE position, the voltage output is controlled by the action of the main INITIATE Switch (17).

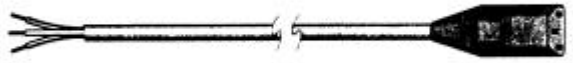
Voltage Output Energized Lamp (25):
When either AC or DC voltage outputs are on, via the Voltage ON/INITIATE Switch (24) or the INITIATE Switch (17), the lamp will be lit.

Protective Ground (Earthing) Terminal (26):
Use this terminal to connect the chassis ground to earth ground.

INPUT POWER INPUT POWER

The SITS-120-115 is rated for 120 volts, 1400 VA max. This unit comes with a standard 15 Amp, North America, power cord, Part Number 51451.

The SITS-120-230 is rated for 240 volts, 1400 VA max. This unit comes with a standard 10 Amp, International Color code power cord as shown below. The cord, part number 15065, is ready for wiring to the appropriate plug (depending on country). The following colors apply, Brown = Line, Blue = Neutral and Green/Yellow = Ground.



SELECTION OF OUTPUT TERMINALS

The AVO Model SITS-120 Secondary Injection Test Set has four current-rated output terminals at various voltage and current ratings provided to adapt the unit to a wide variety of test circuit impedance's. Two pair of voltage output terminals are provided for variable AC/DC voltage applications.

The SITS-120 can be operated most efficiently for current applications by using the terminal with the HIGHEST CURRENT-LOWEST VOLTAGE rating suitable for the test. In this way, finer adjustment can be obtained by making full use of the variable autotransformer range. Even the smallest currents can be obtained from the high-current terminals. The LOW CURRENT-HIGH VOLTAGE terminals should be used when testing high-impedance devices, where the low voltage terminal will not "push" the desired test current through the device(*). The operator should start with the lowest voltage terminal and move to a higher voltage terminal only when necessary.

The highest current-rated terminal has a lower voltage range for the current produced but has much higher resolution for current adjustments (i.e. the **CURRENT** Output Control Knob must be rotated a greater distance for small changes in current output). The lower current-rated terminals have a higher voltage range for the current produced, providing more current "push" but have less control resolution.

(*) When making a timing test on an overcurrent relay, it is suggested that the lower current rated terminals be used. The lowest current-rated terminal has much higher voltage available, which will tend to nullify the effect of relay core saturation, thus producing test times matching the relay manufacturer's published time curves within allowable tolerances.

IT SHOULD BE NOTED THAT THERE IS NO RELATIONSHIP BETWEEN THE AMMETER RANGES AND THE RATING OF THE OUTPUT TERMINAL. All ammeter ranges can be used in conjunction with any of the output terminals.

The voltage output has two sets of terminals, one for AC one for DC. Any voltmeter range can be used at any output setting provided the maximum limit of the range is not exceeded.

The current and voltage output terminals are <u>never</u> to be used interchangeably. Never use more than one current-rated output terminal at a time and only in conjunction with the current output common terminal. **Warning: Never apply an external voltage or current to any output terminals of the test set.**

SERVICE DATA
MAINTENANCE INSTRUCTIONS

Maintenance intervals depend on usage, but a maximum of every six months is recommended.

WARNING: Do not service unit unless it is disconnected from its power source.

1. Enclosure: The enclosure can be cleaned with a soft cloth. If heavily soiled, the cloth can be dampened with an approved solvent that does not attack the finish or leave residue.

2. Control Panel: The control panel can be wiped clean with a soft, dry cloth. Do not wipe the meter lenses with a cloth. If a breath of air will not remove dirt, brush it away lightly with a soft-bristle instrument brush.

3. Variable Autotransformer: The brushes are designed for long life, but should be checked periodically for excessive wear or chipping. The brushes must be changed before the brass brush-holder touches the contact surface or serious damage will result. The brush contact area should be inspected for burning, pitting, dirt or debris. If necessary, burnish surface with burnishing tool, remove filings and clean surface with a swab moistened with alcohol.

4. Other Components: Check all knobs, printed circuit boards, screws, fasteners, connections and terminals for tightness and proper position. Remove dust with a soft brush and breath of air. Output terminal connection tightness is particularly important. If they become loose, excessive heating of the terminals and poor current output will result.

5. Insulation: Check wiring and other insulated components for burning, cracking or other damage.

IMPORTANT NOTES

Do not use lubricants or solvents of any kind in the test set except as specifically recommended.

If damage or malfunction is suspected or repairs deemed necessary, consult a AVO INTERNATIONAL Representative for assistance if it is unclear what course of action is needed. Be sure to provide all name plate data when making inquiries.

BASIC TROUBLESHOOTING

The troubleshooting information relies on the technician to have a through understanding of the operation of the unit. If the technician is unfamiliar with the unit, he or she should not attempt to repair. The technician should contact the factory before attempting repairs. Provide the AVO Multi-Amp part number for the part or assembly in question and the serial number of the SITS-120 when making inquiries.

WARNING

It may become necessary to energize the SITS-120 to properly troubleshoot some of the outputs. The technician must take all applicable safety precautions for working on energized circuits.

NOTES

Before suspecting a failure in the SITS-120, review the **Description of Controls** and **Theory of Operation** sections to ensure that the problem is not a result of operating error.

Preliminary testing of the SITS-120 within its specified limits can help determine if a malfunction actually exists, identify the type of malfunction and define the general area of the failure.

Common causes of malfunctions, other than improper operation, are incorrect power input (voltage above or below specified limits), incorrect test signal voltages applied to the Timer Monitor/Start/Stop gates (outside of the specified AC/DC Applied/Removed limits), and contact or circuit resistance too great for the Dry Contact gates to operate properly on the Monitor/Stop gate. Other common causes are blown fuse(s), cracked, broken or missing brushes on the variable autotransformers, and burned or corroded windings on the variable autotransformers.

Power Input

Input voltage affects the whole unit and may or may not cause permanent damage if voltage is incorrect. These problems can often be corrected by simply using a better source of input power. The rated voltage limits are 120 or 240 volts (see rated voltage on front panel of unit) ± 10 %.

Some symptoms are as follows:

1. Low voltage: Erratic operation, no output, fuse operation.

2. High voltage: Fuse operation, power supply failure.

Basic troubleshooting of the input power and front panel controls are as follows.

1 1. No power:
   A. Check power source and line cord.
   B. Check mains input fuse(s). Note that the 240 volt unit has 2 fuses.

C. Displays blackout could be a power supply failure, or power supply in-line fuse. **WARNING: If displays are blacked out, but the output(s)-energized lamps are lit, the output(s) are energized.** To check the power supply and in-line fuse, remove the unit from the chassis (see 'Removal of Chassis' below to inspect the power supply).

2. Erratic output voltage or current:
   A. Individual output voltage or current not available. Check appropriate fuses, F2 for voltage and F1 for current outputs.
   B. Check test leads for broken conductors.
   C. Output voltage or current varies greatly up or down without moving the control knob. Check for broken or cracked brush on variable autotransformer (see 'Removal of Chassis' below to inspect the brushes).
   D. Sudden increases or drops in output voltage or current when slowly turning the control knob, or sudden restraint when turning control knob. Check for burned or corroded windings on variable autotransformer (see 'Removal of Chassis' below to inspect the windings).

3. Removal of Chassis from Enclosure:
   To remove the chassis,
   A. Disconnect the power cord from the unit.
   B. Carefully remove the four- (4) screws located on the front panel, two on each side.
   C. Hold the unit with both hands using the two lifting handles attached to the front panel. Carefully lift the unit from the enclosure.

Timer / Monitor Section

Basic troubleshooting is as follows:

1. No Timer display when the SITS-120 is energized:
   Power supply failure, defective display IC's, defective components on printed circuit board, loose cable connection between power supply and printed circuit board. See "No Power" above for corrective action.

2. Weak or defective display:
   Poor supply voltage, defective display(s), and defective components on display board. See 'No Power' above for corrective action.

3. Problems with SEC/CYCLES selection:
   Defective selector switch (es) on the Control Panel, defective circuit or defective IC's on timer board. More than likely, problem is selector switch on Control Panel (see 'Removal of Chassis' above to inspect the switches and printed circuit boards). If timer board is suspect, contact factory or representative for return instructions.

4. Timer will not Start or Stop counting. Check the Start/Stop selector switches for proper selection. Check to make sure the Timer Latch Switches are properly set. If the Timer will not stop when using the C.A. (Current Actuate) mode, check to make sure the Timer Start Latch is OFF. If the Timer will not Start when Initiating the output, check to make sure the Timer Start is set to the Initiate position. Check tightness of the appropriate selector switches. If the setscrew has slipped, the switch pointer may not be indicating the proper selection.

5. Counting errors:
AC applied or removed Start/Stop signals can create, what appears to be poor repeatability, an inaccuracy or a malfunction in the Timer. The lower the voltage level, the more serious the "error" will be. What appears to be an error, however, is actually a variation in the point on the sine wave at which the voltage is great enough to cause the gate circuit to operate. If the circuit used for the timing test has a low AC voltage and the point at which the contact in the test circuit opens or closes, is at or close to zero on the sine wave, the period of time before the voltage level will be high enough to trigger the gate circuit can be as much as 4 milliseconds. The total timing variation can be as much as 8 milliseconds. The shorter the duration of the timing test, the more significant the variation becomes. Therefore, if small timing variations would present a problem, it is recommended that an AC voltage of 115 volts or above or a DC voltage be used for voltage applied/removed test selections.

When the SITS-120 Timer calibration is being tested, the AC voltage variable is often overlooked. This is particularly true when the Timer is compared to a counter and the two are triggered simultaneously with an electronic switch. For best results, a DC voltage should be used to eliminate the variable. If testing the AC voltage Start/Stop characteristics is desired, then the Start/Stop signal must be triggered at the same point on the sine wave to assure that the gate signal will be repeatable. Ideally, the signal should be at a point near peak in the positive direction. In addition, the specified rms AC voltage values for the various Start/Stop control selections must be adhered to.

If a timing error or variation persists after all the suspected causes of error have been eliminated, then it is fairly certain the Timer is malfunctioning. Contact factory for return instructions.

Voltmeter / Ammeter Section

Basic troubleshooting is as follows:

1. No Meter display when the SITS-120 is energized:
   Power supply failure, defective display IC's, defective components on printed circuit board, loose cable connection between power supply and printed circuit board. See “No Power” above for corrective action.

2. Weak or defective display:
   Poor supply voltage, defective display(s), and defective components on display board. See ‘No Power’ above for corrective action.

3. Problems with Volts or Amps selection:
   Defective selector switch on the Control Panel, defective circuit or defective IC's on the printed circuit board. More than likely, problem is selector switch on Control Panel (see ‘Removal of Chassis’ above to inspect the switches and printed circuit boards). If the printed circuit board is suspect, contact factory or representative for instructions.

WARRANTY

AVO INTERNATIONAL warrants to the original purchaser that the product is free of defects in material and workmanship for a period of one year from the date of shipment. This warranty is limited and shall not apply to equipment which has damage, or cause of defect, due to accident, negligence, improper operation, faulty installation by the purchaser, or improper service or repair by any person, company or corporation not authorized by AVO INTERNATIONAL.

AVO INTERNATIONAL will, at its option, either repair or replace those parts and/or materials that it deems to be defective. Any costs incurred by the purchaser for the repair or replacement of such parts and/or materials shall be the sole responsibility of the original purchaser.

THE ABOVE WARRANTY IS IN LIEU OF ALL OTHER WARRANTIES, EITHER EXPRESSED OR IMPLIED ON THE PART OF AVO INTERNATIONAL, AND IN NO EVENT SHALL AVO INTERNATIONAL BE LIABLE FOR THE CONSEQUENTIAL DAMAGES DUE TO THE BREACH THEREOF.

TEST APPLICATIONS

The SITS-120 unit is designed for shop or field testing of protective relays, auxiliary relays, molded case circuit breakers and overload coils. Other test applications include thermal or magnetic motor overloads, in-line motor cut-outs, relay coils, panel board ammeters and voltmeters and ratioing current transformers. The independent Start and Stop gates on the Timer provide the capability to measure the operating time of protective relays, EHV to low voltage circuit breakers, trip circuits, contactors or other similar switching devices. **WARNING: Do not use the test set for other applications not specified above that could endanger the operator or the device under test. For example, do not use the voltage output to ratio a potential transformer, since extra high voltages may be generated by the transformer.**

TEST PROCEDURES

TIME DELAY OVERCURRENT DEVICES

1. Set-up SITS-120 with:
   a. Power ON/OFF switch in OFF position (instrument displays should be off).
   b. OUTPUT Control knobs at minimum, "0" position.
   c. INITIATE Switch in center OFF position.
   d. VOLTAGE INIT/ON Switch in the INIT position.
   e. TIMER START Switch in the INITIATE position.
   f. TIMER START/STOP LATCH Switches ON.

2. Connect one end of a high-current lead to one side of thermal element or current coil in overload relay. Connect the other end of this lead to the COMMON terminal of the current output of the SITS-120 Unit.

3. Connect one end of second high-current lead to the other side of thermal element or current coil in overload relay. Connect other end of this lead to output terminal with highest current-rating (See SELECTION OF OUTPUT TERMINALS).
   NOTE: If testing a ground overcurrent relay on a low tap setting, i.e., 0.5, it is recommended that you use the 5A output tap.

4. Connect test set to suitable single-phase power supply.

5. Turn test set ON with POWER ON/OFF switch (instrument displays should light).

6. Select AMPS meter mode.

7. Use Range Switch to select ammeter range so test current will be near full scale and no less than 10% of full scale.

8. Put ammeter DISPLAY Mode in MEMORY position.

9. Connect a pair of light leads (timer leads) from Trip Contacts of overload relay to terminals of test set labeled STOP/MONITOR.

10. Select appropriate timer STOP Mode, i.e., N.O. (Normally Open).

11. Select desired timer-display mode and scale, i.e., SEC's (Seconds) and 0.01. Reset TIMER by pressing RESET button.

12. Rotate CURRENT Control knob clockwise and momentarily press INITIATE Switch in MOMENTARY and release. Observe current reading retained by ammeter.

13. Continue to rotate CURRENT Control knob clockwise while jogging (repeatedly moving to MOMENTARY position and releasing) INITIATE Switch until desired test current is reached. Suggested test current is three times (3X) the rating of thermal overloads or three times (3X) the pick-up current of magnetic overloads.

    If desired test current is not reached with CURRENT Control knob at maximum clockwise rotation, return knob to zero and transfer output lead to terminal with next lower current-rating. Proceed with current adjustment as in Steps 12 and 13.

    NOTE: Before starting test, allow time for thermal element to cool; or in the case of magnetic overload relays, for the piston to reset. Incorrect tripping time may otherwise result.

14. Put ammeter DISPLAY Mode in NORMAL position.

15. Start test by moving INITIATE Switch to MAINTAIN position.

    NOTE: Test current may decrease (fall off) during the test because the resistance or impedance of the test circuit increases as it heats up. Rotate CURRENT Control knob clockwise to keep test current at desired value.

16. When overload relay trips, timer stops and output is de-energized. Timer indicates total elapsed time of the test in seconds or cycles.

17. Turn test set OFF with POWER ON/OFF switch.

IMPORTANT NOTE

In order to obtain accurate tripping times with some types of magnetic overload relays, particularly those using high viscosity oil, it may be necessary to "preheat" the relay by running rated current through the relay for a few minutes.

INSTANTANEOUS ELEMENT OF OVERCURRENT RELAYS

1. Set-up SITS-120 with:
   a. Power ON/OFF switch in OFF position.
   b. OUTPUT Control knobs at minimum, "0" position.
   c. INITIATE Switch in center OFF position.
   d. VOLTAGE INIT/ON Switch in the INIT position.
   e. TIMER START Switch in the INITIATE position.
   f. TIMER START/STOP LATCH Switches ON.

2. Connect one end of a high-current lead to one side of instantaneous element in overload relay. Connect other end of this lead to the COMMON terminal of the current output of the SITS-120 Unit.

3. Connect one end of second high-current lead to other side of instantaneous element in overload relay. Connect other end of this lead to output terminal with highest current-rating (SELECTION OF OUTPUT TERMINALS).

4. Connect test set to suitable single-phase power supply.

5. Turn test set ON with POWER ON/OFF switch (instrument displays should light).

6. Select AMPS meter mode.

7. Use Range Switch to select ammeter range so test current will be near full scale and no less than 10% of full scale.

8. Put ammeter DISPLAY Mode in MEMORY position.

9. Connect a pair of light leads (timer leads) from Trip Contacts of overload relay to terminals of test set labeled STOP/MONITOR.

10. Select appropriate timer STOP Mode, i.e., N.O. (Normally Open).

11. Select desired timer-DISPLAY Mode and scale, i.e., SEC's (Seconds) and 0.001. Reset TIMER by pressing RESET button.

12. Rotate CURRENT Control knob clockwise and momentarily press INITIATE Switch in MOMENTARY and release. Observe current reading retained by ammeter.

    If desired test current is not reached with CURRENT Control knob at maximum clockwise rotation, return knob to zero and transfer output lead to terminal with next lower current-rating: Proceed with current adjustment as in Step 12.

13. Continue Step 12 until overload relay trips. Observe current reading retained on ammeter. Timer indicates elapsed time of test in cycles or seconds.

    NOTE: To avoid tripping error caused by interference of time delay element, allow time for thermal element to cool; or in the case of magnetic overload relays, for the piston or disk to reset.

14. Repeat Step 12, starting with CURRENT Control knob at position just below trip current of instantaneous element observed in Step 13, to verify trip time accuracy.

15. When overload relay trips, timer stops and output is de-energized. Current reading is retained on ammeter. Timer indicates elapsed time in seconds or cycles.

16. Turn test OFF with POWER ON/OFF switch.

IMPORTANT NOTE

Refer to manufacturer's instructions for instantaneous trip time. If increasing test current does not decrease tripping time, current at which minimum tripping time was first observed is the instantaneous trip current value.

TIME DELAY VOLTAGE RELAYS

1. Set-up SITS-120 with:
   a. Power ON/OFF switch in OFF position (instrument displays should be off).
   b. OUTPUT Control knobs at minimum, "0" position.
   c. INITIATE Switch in center OFF position.
   d. VOLTAGE INIT/ON Switch in the INIT position.
   e. TIMER START Switch in the INITIATE position.
   f. TIMER START/STOP LATCH Switches ON.

2. Connect one end of a voltage lead to one side of voltage relay coil. Connect other end of this lead to one of the voltage output terminals of the SITS-120 Unit.

3. Connect one end of a second voltage lead to the other side of voltage relay coil. Connect the other end of this lead to the other voltage output terminal of the SITS-120 Unit.

4. Connect test set to suitable single phase power supply.

5. Turn test set ON with POWER ON/OFF switch (instrument displays should light).

6. Select VOLTS meter mode.

7. Turn ammeter/voltmeter RANGE SWITCH to desired range.

8. Put ammeter/voltmeter DISPLAY Mode Switch in NORMAL position.

9. Connect a pair of light leads (timer leads) from Normally Open Contacts of voltage-controlled relay to binding posts of SITS-120 Unit labeled STOP/MONITOR.

10. Select NORMALLY OPEN timer STOP Mode.

11. Reset TIMER by pressing RESET Switch. Put INITIATE Switch in MAINTAIN position.

12. Rotate VOLTAGE Control knob clockwise until desired voltage is reached.

13. Return INITIATE Switch to OFF position.

14. Allow relay to reset. Reset TIMER by pressing RESET Switch. Put INITIATE Switch in MAINTAIN position.

15. Maintain voltage with VOLTAGE Control knob as relay operates.

16. When relay contacts close, timer stops and output is de-energized. Timer indicates total elapsed time in seconds or cycles.

17. Turn test set OFF with POWER ON/OFF switch.

PICKUP and DROPOUT TEST PROCEDURE FOR VOLTAGE CONTROLLED RELAYS

1. Set-up SITS-120 with:
   a. Power ON/OFF switch in OFF position (instrument displays should be off).
   b. OUTPUT Control knobs at minimum "0" position.
   c. INITIATE Switch in center OFF position.

2. Connect one end of a voltage lead to one side of voltage relay coil. Connect other end of this lead to one of the voltage output terminals of the SITS-120 Unit.

3. Connect one end of second voltage lead to the other side of voltage relay coil. Connect other end of this lead to the other voltage output terminal of the SITS-120 Unit.

4. Connect test set to suitable single-phase power supply.

5. Turn test set ON with POWER ON/OFF switch (instrument displays should light).

6. Select VOLTS meter mode.

7. Turn ammeter/voltmeter RANGE SWITCH to desired range.

8. Put ammeter/voltmeter DISPLAY Mode Switch in NORMAL position.

9. Select MONITOR on timer STOP Mode selector switch. Switch TIMER START/STOP LATCH OFF.

10. Put VOLTAGE INIT/ON Switch in ON position.

11. Rotate VOLTAGE Control knob clockwise until voltage relay picks up. Note pick up voltage value displayed on voltmeter. Rotate VOLTAGE contact knob until rated voltage is set on the relay.

12. Rotate VOLTAGE Control knob counterclockwise until voltage relay drops out Note drop out voltage value displayed on voltmeter.

13. Return VOLTAGE INIT/ON Switch to INIT position.

14. Turn test set OFF with POWER ON/OFF switch.

IMPORTANT NOTE

Threshold voltage of voltmeter may vary depending on inductance of voltage relay coil.

GENERAL TEST PROCEDURE FOR TIMING

There are literally hundreds of testing applications for the SITS-120 Timer. Various procedures could be recommended by AVO International, however the correct method of timing depends entirely on the recommendations of the manufacturer of the device and the preferences of the user. Therefore, a General Test Procedure has been provided to guide the operator.

1. Set-up SITS-120 with:
   a. Power ON/OFF switch in OFF position (instrument displays should be off).
   b. OUTPUT Control knobs at minimum, "0" position.
   c. INITIATE Switch in center OFF position.

2. Connect test set to suitable single-phase power supply.

3. Turn test set ON with POWER ON/OFF switch (instrument displays should light).

4. Connect a pair of light leads (timer leads) from the device (i.e. Normally Closed Contacts or Normally Open Contacts) to the Timer START Terminals.

5. Select appropriate Timer START function to be used (i.e. N.C. , N.O. etc.).

6. Connect a pair of light leads (timer leads) from the device (i.e. Normally Closed Contacts or Normally Open Contacts) to the Timer STOP Terminals.

7. Select appropriate Timer STOP function to be used (i.e. N.C., N.O. etc.).

8. Switch the START LATCH ON/OFF Switch to the desired position. If it is desired to use the STOP function to stop the timer operation, switch the START LATCH ON. If it desired to use the reversal of the START gate to stop the Timer (such as timing the closing and opening of single contact when measuring the trip-free operating time of a circuit breaker), switch the START LATCH OFF. If it is desired to stop the Timer upon the first stop signal only, switch the STOP LATCH ON. If it desired to have the Timer restart if the stop gate reverses (as when measuring contact bounce), switch the STOP LATCH OFF.

9. Select desired timer-display mode and scale (i.e. SEC'S, 0.01).

10. Reset the Timer by pressing the RESET button. Always reset the Timer before each timing test to assure logic circuits are in the correct state.

11. When the appropriate start and stop gate conditions are applied, the Timer display will indicate the elapsed time of the test.

MOLDED CASE CIRCUIT BREAKERS

Always refer to the manufacturer's literature applicable to the particular circuit breaker before testing. The test operator should be familiar with the operating characteristics of the circuit breaker, the tolerances applicable to the operating characteristics and the means for adjusting the circuit breaker, if any.

The test usually performed on these devices is to verify the time delay characteristics of the circuit breaker when subjected to an overload. Each pole of the circuit breaker should be tested independently. One test point is usually suggested to establish whether the circuit breaker is operating correctly and within the band of the time-current curve for the circuit breaker. The suggested test current is three times (3X) the normal current rating of the circuit breaker.

It is, of course, easiest to make connections and perform the test on circuit breakers if they are removed from the circuit. However, it is not necessary to remove the circuit breaker, as long as the test leads can be connected and the line side of the breaker de-energized. It should be further noted that any leads already connected to the circuit breaker need not be removed when conducting the test. The high-current leads from the test set to the circuit breaker under test should be kept as short as possible and should be twisted to minimize the losses caused by inductive reactance.

Run the test and note the time required for the circuit breaker to trip. If the tripping time exceeds the desired value or if the circuit breaker does not trip at all, the circuit breaker may not be protecting the circuit properly. If the circuit breaker operates too quickly, it may result in unnecessary nuisance trips. It should be remembered that molded case circuit breakers operate within a wide time band. Therefore, precise results should not be sought and, if the circuit breaker trips within the time band, it is considered satisfactory. A tolerance of ±15% is usually acceptable. Look for the circuit breaker that has unusually short time delay or takes an abnormally long time to trip or does not trip at all. In the latter case, electrically operating, and thereby exercising the breaker, may correct the condition.

OVERCURRENT ELEMENT OF CIRCUIT BREAKERS

1. Set-up SITS-120 with:
   a. Power ON/OFF switch in OFF position (instrument displays should be off).
   b. OUTPUT Control knobs at minimum, "0" position.
   c. INITIATE Switch in center OFF position.
   d. VOLTAGE INIT/ON Switch in the INIT position.
   e. TIMER START Switch in the INITIATE position.

2. Connect one end of a high-current lead to one pole of circuit breaker. Connect other end to the COMMON terminal of the current output of the SITS-120 Unit.

3. Connect one end of second high-current lead to other side of same pole of circuit breaker. Connect other end of this lead to output terminal with highest current-rating (See SELECTION OF OUTPUT TERMINAL).

4. Connect test set to suitable single-phase power supply.

5. Turn test set ON with POWER ON/OFF switch (instrument displays should light)

6. Select AMPS meter mode.

7. Use RANGE SWITCH to select ammeter range so test current will be near full scale and no less than 10% of full scale.

8. Put ammeter DISPLAY Mode Switch in MEMORY position.

9. Place timer STOP Mode Switch in C.A. position.

10. Select desired timer-display mode and scale. Switch the TIMER START LATCH OFF and STOP LATCH ON.

11. Rotate CURRENT Control knob clockwise and momentarily press INITIATE Switch in MOMENTARY and release. Observe current reading retained by ammeter.

12. Continue to rotate CURRENT Control knob clockwise while jogging (repeatedly moving to MOMENTARY position and releasing) INITIATE Switch until desired test current is reached. Suggested test current is three times (3X) the rating of the circuit breaker.

    If desired test current is not reached with CURRENT Control knob at maximum clockwise rotation, return knob to zero and transfer output lead to terminal with next lower current-rating. Proceed with current adjustment as in Steps 11 and 12. (See SELECTION OF OUTPUT TERMINAL).

    NOTE: Before starting test, a time for the thermal element to cool, otherwise incorrect tripping time may result.

13. Put ammeter DISPLAY Mode in NORMAL CONT. Position.

14. Start test by moving INITIATE Switch to MAINTAIN position.

    NOTE: Test current may decrease (fall off) during the test because the resistance or impedance of the test circuit increases as it heats up. Rotate CURRENT Control knob clockwise to keep test current at desired value.

15. When circuit breaker trips, timer stops and output is de-energized. Timer indicates total elapsed time of the test in seconds or cycles.

16. Turn test set OFF with POWER ON/OFF switch.

IMPORTANT NOTE

Some types of circuit breakers are intended to trip only under high-current fault conditions, usually ten times (10X) rated current. They have only instantaneous characteristics and therefore will not trip using usual procedure described above. Refer to INSTANTANEOUS TEST PROCEDURES FOR CIRCUIT BREAKERS.

INSTANTANEOUS ELEMENT OF CIRCUIT BREAKER

1. Set-up SITS-120 with:
   a. Power ON/OFF switch in OFF position.
   b. OUTPUT Control knobs at minimum, "0" position.
   c. INITIATE Switch in center OFF position.
   d. VOLTAGE INIT/ON Switch in the INIT position.
   e. TIMER START Switch in the INITIATE position.

2. Connect one end of a high-current lead to one pole of circuit breaker. Connect other end of this lead to the COMMON terminal of the current output of the SITS-120 Unit.

3. Connect one end of second high-current lead to other side of same pole of circuit breaker. Connect other end of this lead to output terminal with highest current-rating. (See SELECTION OF OUTPUT TERMINAL).

4. Connect test set to suitable single-phase power supply.

5. Turn test set ON with POWER ON/OFF switch. (instrument displays should light).

6. Select AMPS meter mode.

7. Use Range Switch to select ammeter range so test current will be near full scale and no less than 10% of full scale.

8. Put ammeter DISPLAY Mode in MEMORY position.

9. Place timer STOP Mode Switch in C.A. position.

10. Select desired timer display mode and scale. Switch the TIMER START LATCH OFF and STOP LATCH ON.

11. Rotate CURRENT Control knob clockwise and momentarily press INITIATE Switch in MOMENTARY and release. Observe current reading retained by ammeter. Reset the timer between each test.

    If desired test current is not reached with CURRENT Control knob at maximum clockwise rotation, return knob to zero and transfer output lead to terminal with next lower current-rating. Proceed with current adjustment as in Step 11. (See SELECTION OF OUTPUT TERMINALS)

12. Continue Step 11 until circuit breaker trips. Observe current reading retained on ammeter. Timer indicates elapsed time of test in cycles or seconds.

    NOTE: To avoid tripping error caused by time-delay element overheating, allow time for it to cool.

14. When circuit breaker trips, timer stops and output is de-energized. Current reading is retained on ammeter. Timer indicates elapsed time in seconds or

cycles.

15. Turn test set OFF with POWER ON/OFF switch.

IMPORTANT NOTE

Refer to manufacturer's instructions for instantaneous trip time. If increasing test current does not decrease tripping time, current at which minimum tripping time was first obtained is the instantaneous trip current value.

MOTOR OVERLOAD RELAYS

Always refer to the manufacturer's literature applicable to the particular overload relay before testing. The test operator should be familiar with the operating characteristics of the relay, the tolerances applicable to the operating characteristics and the means of adjusting the relay, if any.

The test usually performed on these devices is to verify the time delay characteristics of the relay when subjected to an overload. One test point is usually suggested to establish whether the relay is operating correctly and within the band of the time-current curve for relay. The suggested test current is three times (3X) the normal current-rating of thermal overload relays or three times (3X) the pick-up current (setting) of magnetic overload relays.

It is, of course, easiest to make the connections and perform the tests on the relays if they are removed from the starter. However, it is not necessary to remove the relay as long as the test leads can be connected and the circuit de-energized. It should be further noted that any leads already connected to the relay need not be removed when conducting the tests. The high-current leads from the test set to the relay under test should be kept as short as possible and should be twisted to minimize the losses caused by inductive reactance.

Run the test (see TESTING TIME DELAY OVERCURRENT DEVICES) and note the time required for the overload relay to trip. If the tripping time exceeds the desired value, or if the relay does not trip at all, the relay may not be protecting the motor properly. If the relay operates too quickly, it may result in unnecessary nuisance trips. It should be remembered that these devices operate over a wide band and precise results should not be sought. A tolerance of ±15% is usually acceptable.

If a thermal overload relay is not operating properly, tripping too soon or too late, remove the heater element. Note its type, rating, etc., and compare with manufacturer's data for operating characteristics of the motor. If correct for the application, substitute a new heater of the same rating and retest. If improper heater elements are being used, either under or oversized, replace with the proper sized heater and retest.

If a magnetic overload relay is not operating properly, refer to the relay manufacturer's literature for instructions on making adjustments to the time delay. If the relay is operating improperly, it may also be desirable to verify the pick-up point (minimum operating point) of the relay. To perform this test, it is necessary to disengage the time delay feature of the overload relay. Refer to the manufacturer's literature for detailed instructions.

SPECIFICATIONS

Input Power:
120 or 240 Vac (Specify one) ± 10 %, 50/60 Hz

Outputs :
Two independently controlled adjustable outputs are available from the test set... one AC current one AC / DC voltage. The voltage output can be operated either simultaneously or independently from the current output.

Output Current:
Continuously adjustable in the following ranges:

Output Current	Full Load Voltage
0 - 5 Amperes	140 Volts
0 - 10 Amperes	70 Volts
0 - 25 Amperes	28 Volts
0 - 120 Amperes	5 Volts

When the voltage is sufficient to push higher than rated current through the load, the current ratings above can be exceeded for short durations.

Output Current Duty Cycle

Maximum time on is 5 minutes followed by 15 minutes off. Short time overloads are possible. Duty is reduced to 2 minutes on and 15 minutes off at ambient temperature of 122°F (50°C).

AC Voltage Output (Switch Selected)

Output Voltage	Current Rating
0 - 240 Volts	2 Amp

DC Voltage Output (Switch Selected)

Output Voltage	Current Rating
0 - 240 Volts	1 Amp

Voltage Output Duty Cycle
Continuous output up to 4 hours.

Metering
Measured quantities such as AC Current, AC Voltage, DC Voltage and Time, are displayed on large, LED displays. The Ammeter/Voltmeter is a dual purpose meter, whose function is switch selected. When selected as a voltmeter it will measure either AC or DC depending on the selector switch.

AC Ammeter (Switch Selected)

Ranges and Resolution	0 to 1.999/19.99/199.9/400 Amperes
Accuracy:	± 1 % of range
Measurements:	True RMS. Continuous Mode Peak Hold in Memory Mode

AC Voltmeter (Switch Selected)

Ranges and Resolution	0 to 1.999/19.99/199.9/400 Volts
Accuracy:	± 1 % of range
Measurements:	True RMS.

DC Voltmeter (Switch Selected)

Ranges and Resolution	0 to 1.999/19.99/199.9/ 400 Volts
Accuracy:	± 1 % of range
Measurements:	Average

Timer

Display:	The Timer has a five digit LED display.
Range and Resolution:	Displays in either seconds or cycles, with the following range and resolution (switch selected),
Seconds:	a) 0 to 999.99 b) 0 to 99.999
Cycles:	0 to 99999

Accuracy:
± 1 least significant digit or ± .005% of reading, whichever is greater.

Start/Stop/Monitor Gates:
Two identical, independent, Start, Stop or Monitor Gate circuits are provided. To monitor operation of relay contacts or trip SCR, a continuity light is provided for the Stop gate. Upon sensing continuity the monitor lamp will glow and a tone generator will sound. The following modes are provided for the Start, Stop/Monitor Gates:

1. Timer will start, stop or continuity indicator darkens at the opening of normally closed contacts or when conduction through a semiconductor device such as a triac or transistor is interrupted.

2. Timer will start, stop or continuity indicator glows at the closing of normally open contacts or upon conduction through a semiconductor device such as a triac or transistor.

3. Timer will start, stop or continuity indicator glows or darkens upon the application or removal of either an AC or DC voltage (60 to 300 Vac), (5 to 300 Vdc). The maximum voltage to be applied is 300 Volts AC or DC.

4. Starting or Stopping with any selected output. The Timer can be started or stopped when turning on or off any (or all) selected outputs.

5. In the Current Accurate Mode the Timer stops when output current is interrupted.

Start Latch:
The Timer Start Gate is provided with a latch feature which allows timing to be initiated by a Start Gate and to be stopped only by the selected Stop Gate. When unlatched, the Start Latch allows timing to be stopped when the Start Gate is reversed (such as when timing the closing and opening of a single contact as in measuring the trip-free operating time of a circuit breaker).

Stop Latch:
The Timer Stop Gate latch feature which allows timing to be stopped at the first operation of any Stop Gate (thus ignores contact bounce). When unlatched, the Stop Latch allows timing to be stopped by any Stop Gate and then restarted if the Stop Gate reverses (provided a Start Gate is still energized), and then stopped again when the gate reverses (total time including contact bounce).

Protection

Input and outputs are protected from short circuits and prolonged overloads.

Ancillary Interface: A voltage signal output, in phase with the main current output (± 2°, is provided to input into the AVO Models EPS-1000 or PVS-1000 for phase reference. This will allow testing of more complex relays, which require phase shifting between a three-phase voltage output (EPS-1000) and a current output (SITS-120).

Temperature Range

Operating:	32 to 122°F (0 to 50°C)
Reduced duty cycle above:	104°F (40°C)
Storage:	-40 to 158°F (-40 to 70°C)
Relative Humidity:	80%

Enclosure

The unit comes mounted in a rugged plastic transit case for field portability. The tongue and groove lid protects the unit from rain and dust intrusion. Spring loaded carry handles are located on each side for convince.

Dimensions

Unit Enclosure:	11 H x 15 W x 12 D in. 281 H x 383 W x 306 D mm
Weight:	47 lb. (21.4 kg)

OPTIONS AND ACCESSORIES

Included Accessories

Description	Part Number
Line cord, North American (std 115 V model) (1 ea.)	51451
Line cord, International (std 230 V model) (1 ea.)	15065
Instruction Manual (1 ea.)	50377
15 A Input Fuse, (std 115 V model) (5 ea.) T rated	50232
10 A Fuse, (std 230 V model) (5 ea.) T rated	11333
6.25 A Fuse (5 ea.) T rated	FT52
5 A Fuse (5 ea.) T rated	952
Test Lead, red/black (2 pr.), use with voltage outputs and timer	1282
Test Lead, current, (1 pr.), use with current output	7934

Optional accessories are:

#4 High Current Test Leads, 5 ft. [1.5 m] (1 pr.), use when testing breakers 2265

An optional Phase Angle Meter (PAM) interface cable is required to interface the SITS-120 to Multi-Amp Phase Shifters. Different Model Phase Shifters require different interface cables, see below.

Cable, Interface, for Multi-Amp Models CS-6B, CS-7B or PSA-100 (1ea.).....12680
Cable, Interface, for Multi-Amp Models EPS-1000 and PVS-1000 (1ea.) 15746

PARTS LIST

SITS-120

Description	Part No.
Line Filter	6344
Red Lens	8855
Lamp, Incandescent	8857
Lamp Holder	8858
Switch 2PDT	8863
Powerstat	9700
Transformer, Current	12629
Lamp, Neon	14472
Knob, Blk	16592
Power Switch	16363
Switch, 4PDT	17439
Printed Circuit Assy., Logic I Bd.	17435
Switch, Latch	50234
Switch, INIT	50238
Printed Circuit Assy., Logic II Bd.	17472
Lens, 4 Digit	17480
Lens, 5 Digit	17481
Enclosure, Plastic	17503
Handle, Bail, Black	50069
Printed Circuit Assy., Low Voltage Pwr. Supply	50229
Printed Circuit Assy., Triac Control Bd.	50318
Output Transformer, Main	50349
Output Transformer, Voltage	50350
Printed Circuit Assy., I/V Sensor	50415
Switch, Voltage Bypass	506812
Triac Assy, SITS120	51347
Binding Post, Black, Current	MC3452
Binding Post, Red, Current	MC7820
Binding Post, Yellow/Green	MC2342

INSERT SCHEMATICS HERE