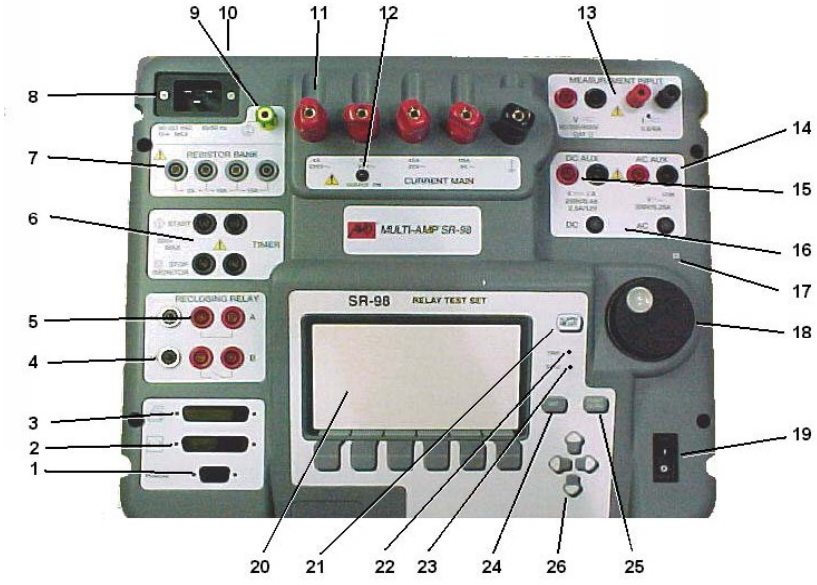
SPECIFICATIONS

DESCRIPTION

The Megger Model SR-98 is the newest addition to the long successful line of Megger "SR" series, like the SR-51, SR-76 and SR-90 relay tests. With almost 50 years of relay testing experience, the SR-98 incorporates the latest in Digital Signal Processor (DSP) and microprocessor-based technology to provide a powerful, easy to use relay test set.

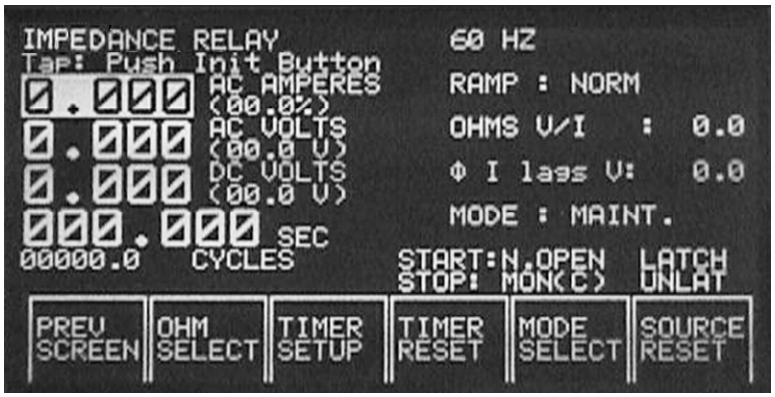
The SR-98 is a multipurpose, lightweight, field portable, test set capable of testing a wide variety of electromechanical, solid-state and microprocessor-based protective relays, small molded case circuit breakers, motor overload relays and similar protective devices.

In the picture below, reference points 1,2 and 3 are interface ports for computer, printer and other SR-98 or Models PVS/EPS-1000. Points 4 and 5 are associated with the circuit breaker simulator circuit. Number 6 is the Timer Start and Stop Gates. Point 7 is the resistor bank. Points 8, 9 and 10 are associated with the power input and ground terminal. Points 11 and 12 are associated with the main current output terminals. Reference point 13 is the external voltage and current measurement terminals. Points 14, 15 and 16 are associated with the AC, DC (AUX) voltage outputs. Number 17 is the system reset button. Point 18 is the control knob. Point 19 is the power on switch. Reference point 20 is the LCD display screen, while 21 is the alarm reset switch. Points 22 and 23 are the TRIP and SYNC LED lamps. Point number 24 is the Initiate switch, and 25 is the Print Screen button. Reference point 26 is associated with the up/down, right/left cursor keys.



The SR-98 incorporates a large, easy to read, LCD display, which displays AC and DC Amperes, AC and DC Volts, and Time in both Seconds and Cycles. Depending on type of test selected, other values may be displayed, such as Ohms, Watts, VARS, Phase Angle, Frequency or Power Factor. Metered quantities such as AC Amperes, AC Volts, DC Volts or DC Amperes, and Time, are all simultaneously displayed on the display screen. The read-and-hold feature of the metering provides fast and accurate preset of test values. Function buttons provide very powerful testing capabilities. A relay specific test screen is provided from a

menu list. The user simply selects what type of relay is to be tested and a test screen is provided that displays all the necessary metering and functions needed to test that type of relay. For example, the SR-98 can test single-phase impedance relays. The test screen for a distance relay is shown below.



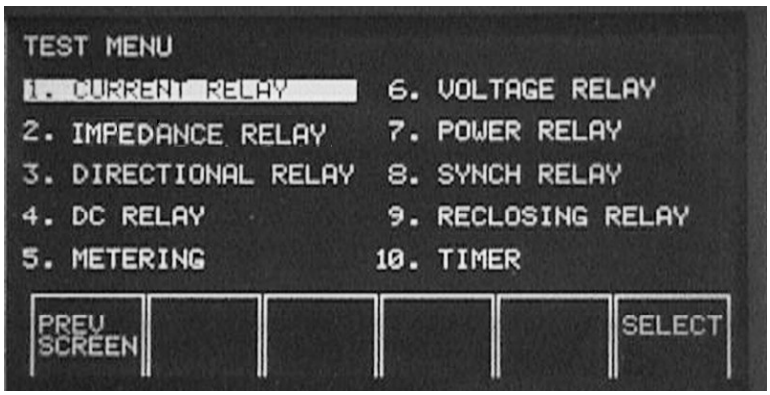
Screens shown have been slightly reduced in size (from actual) for printing purposes

Not only does the display screen show the metered values, but in this example, it also display's the OHMS value where the relay picks up (different formulas for calculating OHMS are selectable using the OHM SELECT function button).

APPLICATIONS

The combination of single-phase AC voltage, AC current, with a variety of fixed output frequencies and phase shift capability, DC voltage, and DC current, provides powerful testing capabilities. For example, the AC Current output can provide 16.66 or 25 Hz, for testing light rail transit system relays. In addition, the AC Current can also be programmed to provide 2nd, 3rd and 5th harmonic currents, for testing harmonic restraint elements in transformer differential relays.

The user simply selects from a menu screen for different testing applications. For example see the TEST MENU below.



As can be seen, the SR-98 can test a wide selection of relay types. The phase shift capability means that the unit can continuously adjust the phase angle relationship

between the voltage and current outputs. Therefore, values like reach, maximum angle of torque, directional balance points and closing angles can be easily tested. In addition, breaker contact simulation provides swift and easy testing of reclosing type relays.

Other types of relays not specifically listed on the menu above can be tested using one of the menu selections. For example, current differential, voltage controlled/restrained overcurrent and current balance relays are tested using the CURRENT RELAY test screen. All single-phase impedance type relays, and some three-phase relays that can be tested single-phase with the voltage coils in parallel and currents in series, are tested using the IMPEDANCE RELAY Test Screen. This would include transmission line protection and loss of field type relays. The SYNCH RELAY Test Screen is used to test synchronizing and sync check relays.

The Metering Screen provides powerful multi-purpose metering functions. Values like Volts, Amperes, Phase Angle, Power, Reactive Power and Power Factor are all simultaneously displayed.

FEATURES AND BENEFITS

- Large variable contrast LCD display screen - Easy to read, no interpolation of analog meter scales. This saves time in testing relays and reduces human error.

- Display screen prompts operator – The display screen prompts the user with easy to understand and use function keys. Single button operation saves time in testing relays and reduces human error.

- Display screen provides five different languages – The display screen prompts the user in English, Spanish, Portuguese, French and German. This saves time in testing relays and reduces human error.

- Output current and voltage sinewaves are generated digitally. Outputs do not vary with sudden changes in the input voltage or frequency, which increases test accuracy and saves testing time.

- Memory hold metering - Allows user to set test currents and voltages faster. Reduces heating of device under test. Saves time in testing relays.

- AC/DC voltage outputs can be operated independently of the AC current output - Can provide DC logic voltage to solid-state relays prior to applying simulated fault current. Also allows user to test voltage controlled / restraint overcurrent relays, without blocking voltage element contacts closed. Eliminates elaborate test circuit connections, purchasing a separate DC voltage source or using station battery.

- Timer has independent Start and Stop Gates - Perform timing functions independent of relay test set operation. Eliminates purchasing a separate timer for timing circuit breakers.

- Current Accurate mode - Multi-purpose test set capable of testing small molded-case circuit breakers and motor overload relays commonly found in industrial

applications.

- Interface port - Provides interface to other SR-98's or MEGGER Phase Shifters. Allows SR-98 unit to be used with another SR-98 to test slope and harmonic restraint characteristics on current differential relays. Allows SR-98 unit to be used with a three-phase phase shifter to test complex three-phase relays. Saves time in making test connections. Multi-purpose test system saves money.

- Phase shift capability (0 to 359.9°) - The SR-98 provides phase shift between the main ac current and auxiliary ac voltage outputs (for testing complex relays), or between the 230 volt output terminal of the main ac current and the auxiliary ac voltage outputs (for testing synchronizing and phase sequence relays).

- Selectable output frequencies - The output frequency of the ac main current can be set for 16.66, 25 Hz (for testing light rail transit relays), 50, 60 Hz (standard power frequency), 100, 120, 150, 180, 250 and 300 Hz (for testing harmonic restraint on transformer differential relays). Multi-purpose test system saves time and money.

- Circuit breaker simulator – Normally closed and normally open contacts are provided to simulate breaker operation for testing reclosing relays. Sequence of operation, timing and lockout are easily tested.

- Non-volatile RAM – Provides storage of special test set-up screens.

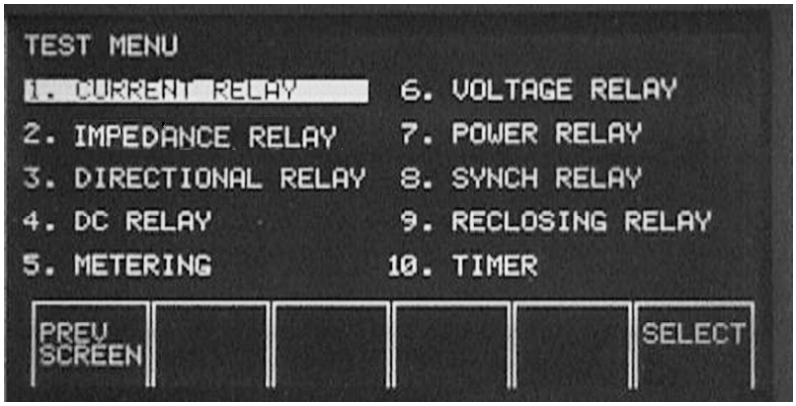
- RS-232 and parallel printer ports – The RS-232 port provides for computer interface. The parallel printer port allows user to easily print test results.

- Universal input voltage – Models SR-98-1 and SR-98-2 can use virtually any standard source in the world. The Model SR-98-3 is designed for 230 Volt operation only.

APPLICATIONS

The combination of single-phase AC voltage, AC current, with a variety of fixed output frequencies and phase shift capability, DC voltage, and DC current, provides powerful testing capabilities. For example, the AC Current output can provide 16.66 or 25 Hz, for testing transit system relays. In addition, the AC Current can also be programmed to provide 2nd, 3rd and 5th harmonic currents, for testing harmonic restraint elements in transformer differential relays.

The user simply selects from a menu screen for different testing applications. For example see the TEST MENU below.



As can be seen, the SR-98 can test a wide selection of relay types. The phase shift capability means that the unit can continuously adjust the phase angle relationship between the voltage and current outputs. Therefore, values like reach, maximum angle of torque, directional balance points and closing angles can be easily tested. In addition, breaker contact simulation provides swift and easy testing of reclosing type relays.

Other types of relays not specifically listed on the menu above can be tested using one of the menu selections. For example, current differential, voltage controlled/restrained overcurrent and current balance relays are tested using the CURRENT RELAY test screen. All single-phase impedance type relays, and some three-phase relays that can be tested single-phase with the voltage coils in parallel and currents in series, are tested using the IMPEDANCE RELAY Test Screen. This would include transmission line protection and loss of field type relays. The SYNCH RELAY Test Screen is used to test synchronizing, sync check and phase sequence relays.

The Metering Screen provides powerful multi-purpose metering functions. Values like Volts, Amperes, Phase Angle, Power, Reactive Power and Power Factor are all simultaneously displayed.

Input Power:

Model Numbers **SR98-1/60** and **SR98-2/50**:
90 to 253 Volts AC, 1ϕ, 50/60 Hz, 1700 VA Max.
Model Number **SR98-3/50**:
230 Volts AC, $\pm$ 10 %, 1ϕ, 50/60 Hz, 1700 VA Max.

Outputs

Three independently controlled adjustable outputs are available from the test set... one AC current, one AC voltage and one DC voltage/current. The voltage outputs are independent from the main current output.

AC Main Output Current
The main AC current output is rated for 920 VA, with four different output terminals continuously adjustable in the following ranges:

Output Current	Full Load Voltage
0 - 4 Amperes	230 Volts
0 - 10 Amperes	90 Volts
0 - 45 Amperes	20 Volts
0 - 115 Amperes	8 Volts

Output current is de-rated at output frequencies less than 50 Hz and greater than 120 Hz. For example, the available output current is less than 50 % of rated tap value at 25 Hz, and less than 20 % at 16.6 Hz. Percentage varies depending on the selected output tap, the test frequency and the load. For example, at the selected output frequency of 180 Hz, you can get 110 Amperes at 7.7 Volts from the 115 Amp output tap, while at 300 Hz you get less than 95 Amperes at 6.7 Volts into the same load. For more information contact the factory.

Output Current Duty Cycle
Maximum time on is 3 minutes followed by 20 minutes off. Duty is reduced to 1 minute on and 20 minutes off at ambient temperature of 122◦F (50◦C).

AC Voltage Output
The AC voltage output is independently controlled and may be phase shifted relative to the Main AC Current/Voltage outputs.

Output Voltage	Current Rating
0 - 230 Volts	4 Amp (AC CURRENT MAIN)
0 - 300 Volts	0.25 Amp (AC AUX)

DC Voltage/Current Output (Switch Selected)

Output Voltage	Current Rating
0 - 240 Volts	0.4 Amp

Output Current	Voltage Rating
0 – 2.5 Amps	12 Volts

AC/DC Output Voltage Duty Cycle
30 Minutes on followed by 30 minutes off.

Metering
Measured quantities such as AC Amperes, AC Volts, DC Volts or DC Amperes, and Time, are all simultaneously displayed on the large variable contrast LCD screen. The read-and-hold feature of the metering provides fast and accurate preset of test values. The AC Amperes also displays a percent value when rotating the control knob for easy reference by the user. The AC and DC Volts display the expected voltage output prior to initiation of the voltage outputs. This provides a fast and easy method for preset of voltage outputs. As a safety feature, it also alerts the user to the expected voltage output prior to turning the voltage outputs on. Other values, which may be displayed depending on which test screen is in view, are Phase Angle, Power, Reactive Power and Power Factor. The large characters and variable contrast make the display easy to read from 3 to 4 feet (1 meter) away, even in direct sunlight. All accuracy stated below are for 10 to 100 % of Full Scale at 50/60 Hz.

AC Amperes (Auto Ranging)

Ranges and Resolution	0 to 1.999/19.99/199.9 Amperes
Overall Accuracy	
Continuous Mode:	± 1 % of reading
Pulse (4 to 10 Cycles):	± 1.5 % of reading
Pulse (1 to < 4 Cycles):	± 2 % of reading ± 1 digit
Measurements:	True RMS

AC Volts (Auto Ranging)

Ranges and Resolution	0 to 19.99/199.9/999.9Volts
Accuracy:	± 1 % of reading, ± 200 mV on low range
Measurements:	True RMS

DC Volts (Auto Ranging)

Ranges and Resolution	0 to 19.99/199.9/ 999.9Volts
Accuracy:	± 1 % of reading, ± 200 mV on low range
Measurements:	Average

DC Amperes (Auto Ranging)

Ranges and Resolution	0 to 1.999/19.99 Amperes
Accuracy:	± 1 % of reading
Measurements:	Average

Phase Angle

Ranges and Resolution	0 to 359.9 Degrees
Accuracy:	± 0.5 Degrees

Power Factor

Ranges and Resolution	-0.99 to +0.99, with 0.01 resolution
Accuracy:	± 0.02

Power (Auto Ranging)

Ranges and Resolution	0 to 4 kW in 6 ranges, with 0.1 % resolution
Accuracy:	± 1.5 % of VA, ± 1 digit

Reactive Power (Auto Ranging)

Ranges and Resolution	0 to 4 kVAR in 6 ranges, with 0.1 % resolution
Accuracy:	± 1.5 % of VA, ± 1 digit

Timer

Range and Resolution:	Displays in either seconds and cycles, with the following range and resolution
Seconds:	0.0001 to 99999.9 (Auto Ranging)
Cycles:	0.01 to 99999.9 (Auto Ranging)
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 selected outputs.

5. In the Current Actuate 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 (± 3◦), is provided to input into the MEGGER 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 (SR-98).
Temperature Range	
Operating:	32 to 122◦F (0 to 50◦C)
Reduced duty cycle:	Duty cycle is linearly de-rated from 3 minutes on, starting at 104◦F (40◦C) to 1 minute on at 122◦F (50◦C), followed by 20 minutes off.
Storage:	-40 to 158◦F (-40 to 70◦C)
Relative Humidity:	90% RH, Non-condensing

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:	17.75 H x 16.5 W x 15.5 D in. 444 H x 416 W x 387 D mm
Weight:	51.5 lb. (23.4 kg) Cover Lid On 48.8 lb. (22.2 kg) Cover Lid Off

OPTIONS AND ACCESSORIES

Included Accessories

Description	Part Number
Line cord, North American (Model SR-98-1/60) (1 ea.)	620000
Line cord, Continental Europe (Model SR-98-3/50) (1ea.)	50425
Line cord, International (Model SR-98-2/50) (1 ea)	51874
Instruction Manual (1 ea)	51187
15 A Input Fuse, (for 120 Volt input) (5 ea.) T rated	963
8 A Input Fuse, (230 Volt input) (5 ea.) T rated	962
Test Lead, red, 200 cm, use with voltage outputs and timer (3 ea.) CAT II	684000
Test Lead, black, 200 cm, use with voltage outputs and timer (3 ea.) CAT II	684001
Lug Adapter, red, 6.2 mm, use with voltage outputs and timer (2 ea.) CAT II	684002
Lug Adapter, black, 6.2 mm, use with voltage outputs and timer (2 ea.) CAT II	684003
Lug Adapter, red, 4.1 mm, use with voltage outputs and timer (2 ea.) CAT II	684004
Lug Adapter, black, 4.1 mm, use with voltage outputs and timer (2 ea.) CAT II	684005
Alligator Clip, red, use with voltage outputs and timer (1 ea.) CAT II	684006
Alligator Clip, black, use with voltage outputs and timer (1 ea.) CAT II	684007
Test Leads, red/blk, use with current output (includes spades) (1 pr.) CAT II	7934
Carry Case, Test Lead	684008

NOTE: SR 98-3/50 comes with line cord and instruction manual only (no test leads)

Optional accessories are:

#4 High Current Test Leads, 5 ft. [1.5 m] (1 pr.), use when testing molded case breakers	2265
SR-98 Software	750014

For three-phase applications, an optional Phase Angle Meter (PAM) interface cable is required to interface the SR-98 to Megger Three-Phase Phase Shifters.

Cable, Interface, for Models EPS-1000 and PVS-1000 (1ea	51680
Cable, Interface, Master/Slave, for SR-98 to SR-98 (1ea)	51679

PARTS LIST

SR-98

Description	Part No.
Line Filter	51631
Keypad	51614
Resistor, 2A, 23 OHM	IL81
Resistor, 10A, 1.88 OHM	FL72
Resistor, 15A, .94 OHM	FL73
Fuse, Reset	50623
Transformer, Current	12629
Input Power Receptacle	51447
Knob, Control	50615
Power Switch	14246
Display Screen	50501
Fuse Holder	51438
Connector, Female, Voltage, Red	51698
Connector, Female, Voltage, Blk	51699
Power Supply, 60 W	50704
Filter, Printer Circuit Bd. Assy.	50759
Fan, SQRL	51223
Enclosure, Plastic	50521
Output Transformer, Main	51348
Output Transformer, Voltage	51593
Ground Terminal	50616
Input Terminal, Current, Red	50617
Input Terminal, Current, Blk.	50618
Binding Post, Black, Current	MC3452
Binding Post, Red, Current	MC7820
Binding Post, Yellow/Green	MC2342