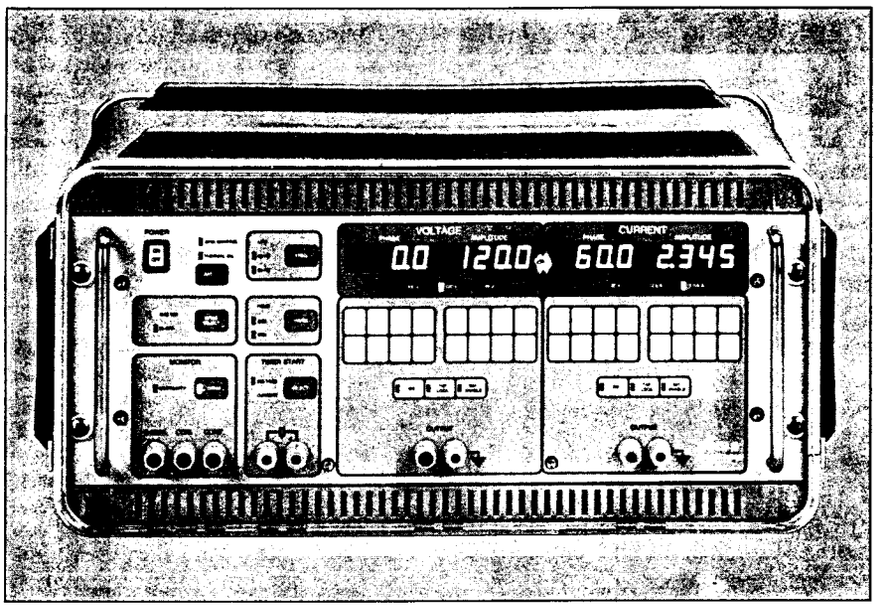
AVO INTERNATIONAL

THE MEASURE OF EXCELLENCE IN ELECTRICAL TESTING



MULTI-AMP® EPOCH-10®

- **Microprocessor-based relay test equipment**
- **Industry standard**
- **IEEE-488 GPIB**
- **Cornerstone of protective relay testing**

Protective Relay Test Set

DESCRIPTION

The Multi-Amp® EPOCH-10® relay test set integrates advanced microprocessor-based technology with decades of experience in the application, design and manufacture of equipment for calibrating protective relays to provide an extremely accurate, versatile and easy-to-use relay test set.

Intended for field use at substations and power plants, the EPOCH-10 is a portable, lightweight and very rugged test set. Its versatility makes it ideal for use in the relay shop, in the test laboratory or on the production line.

A single EPOCH-10 provides a variable current output, a variable voltage output, adjustable phase-angle settings, a harmonic generator and comprehensive control and monitoring circuits. Interconnecting two or three units creates an open-delta three-phase test system, or a complete three-phase test system consisting of six independently adjustable, phase-shiftable outputs, three voltages and three currents. The EPOCH-10 can be used with other members of the EPOCH® Family to provide more comprehensive facilities when required.

APPLICATIONS

With the modular design of the EPOCH family, you can select the unit(s) with the capabilities and features required by your present application, and add

IEEE Device Number	Relay Types	Specify
50	Instantaneous Overcurrent*	One EPOCH-10
51	Overcurrent*	
67	Directional Overcurrent*	
67N	Ground Directional Overcurrent*	
21	Distance (1ϕ)	
32	Directional Power (1ϕ)	
40	Loss of Field	
87	Differential	Two EPOCH-10s
59	Overvoltage	
27	Undervoltage	
25	Synchronizing	
21	Distance (open-delta)	
21	Distance (3ϕ WYE)	Three EPOCH-10s
32	Directional Power (3ϕ)	
46	Negative Sequence Overcurrent	
81	Frequency	One EPOCH-10
25	Autosync/Syncverifier Synchronizing	One EPOCH-30

*For higher currents (up to 187 amperes) or higher volt-amperes, use EPOCH-20® (600 VA) or EPOCH-II® (1000 VA) with the EPOCH-10.

to your original unit(s) as your testing needs expand. The table lists the different types of relays by IEEE device numbers and the different EPOCH-10 combinations that would be required to test them.

When performing automated relay testing with a computer and an EPOCH-10, Multi-Amp PulseMaster® software gives you the option of using the computer to perform timing tests. This eliminates the requirement for a separate timer. The accuracy of the computer-based timing method is approximately ±20 ms with IBM PCs and compatibles. When high-speed or high-accuracy timing is required, use either the EPOCH-30®, EPOCH-40® or the EPOCH-V®.

FEATURES AND BENEFITS

Many standard features are incorporated in each EPOCH-10 to reduce setup time, simplify test procedures and increase accuracy. Among these are:

- Each EPOCH-10 is a self-contained test set and provides variable current, variable voltage, phase shifting, control and monitoring functions.
- Current, voltage and phase angle settings are each independently incremented by 4-digit raise and lower pushbutton controls that automatically increment to the next decade whenever a decade-changing value is reached.
- Amplitude and phase angle of the output current and voltage are displayed on large, high-intensity LED displays that remain active even when the test set is under automatic computer control.
- Autoranging is provided on amplitude controls to provide resolution corresponding to the output magnitude.
- Automatic output-current tap selection provides impedance matching to load.
- Typical accuracy of voltage and current outputs is ±0.5% of setting.
- Phase angle accuracy is typically ±0.2% of setting.
- Output frequency is synchronized to input line or crystal controlled at 50/60 Hz.
- Audible alarm and display indication are given whenever amplitude, phase angle or waveform of the outputs is in error.
- A harmonic generator circuit converts the current and potential outputs to either a second, third or fifth harmonic.
- Output-current source has a continuous duty cycle rating of 100 VA.
- Output-potential source has a continuous duty cycle rating of 75 VA.
- Three output-current ranges are provided, with a resolution of 0.001 ampere on the low range and 0.01 ampere on the two upper ranges.
- Three output-potential ranges are provided, with a resolution of 0.01 volt on the low range and 0.1 volt on the two high ranges.
- The output current of two or three test sets can be connected in parallel to increase the maximum current available to 50 amperes (two units) or to 75 amperes (three units).
- The output potential of two test sets can be summed together to increase the maximum potential available if the load is not grounded.
- With two or three EPOCH-10s used together, any one of the four or six outputs can be the reference against which the phase angle of all the others is set.
- Optional IEEE-488 interface transforms the unit into an automatic, programmable test system.
- Numerous protective circuits are incorporated, including thermal pro-tection of the power amplifiers and overvoltage protection of the input circuit.
- An isolated contact monitoring and sensing circuit is incorporated to monitor dry contacts, SCR conduction and voltage signals.
- A circuit is incorporated to initiate an external timer simultaneously with any output.
- Tough polyethylene-plastic, sealed enclosure provides a high-shock and vibration resistance. Rubber sealed lids protect the test set from water and dust intrusion.
- Completely compatible with all EPOCH units.
- For maximum flexibility in controlling the outputs, a three-mode output initiating circuit is provided. When desired, either the current or potential output, or both outputs, can be independently switched "on" and/or "off."

When two or three EPOCH-10s are used together, any or all can be initiated simultaneously by using the initiating switch on any one of the test sets.

- To monitor operation of the trip contact or trip SCR in the relay under test, a continuity light and an audible tone generator are provided. Additionally, an isolated circuit is provided that is voltage sensing and can monitor solid-state logic signals. This circuit senses a positive-going signal and sounds the tone generator and illuminates the continuity light upon application of the 5- to 250-volt ac or dc signal.
- A special harmonic generator is incorporated to test relays that include harmonic restraint elements.

This circuit provides the capability of converting the output current and potential to either a second, third or fifth harmonic of the input line or crystal oscillator frequency. Thus, by simple use of a panel switch, the test technician can select a 50-, 60-, 100-, 120-, 150-, 180- or 300-Hz current and potential output.

When testing the harmonic restraint element of a transformer differential relay, two EPOCH-10s are required: one to provide the fundamental current and the other to provide the desired harmonic current. The two currents are connected in parallel to produce the desired test current.

- Input line and dc power supply are fuse protected. Additionally, overvoltage protection is provided on the input line circuit. The power amplifiers are forced-air cooled and are protected by thermal overload relays. Audio and visual alarms indicate whenever the current or potential outputs are overloaded.
- To simulate the worst of field conditions, the EPOCH-10 has been tested and qualified in accordance with MIL-STD-810 for temperature, shock and vibration.

SPECIFICATIONS

Input

Input Voltage (specify one)

115 V ±10%, 1φ, 50/60 Hz
OR
230 V ±10%, 1φ, 50/60 Hz

Output

Output Frequency

- Synchronized to input power source
- Synchronized to external frequency source (EPOCH-30 may be used to establish the frequency output of the EPOCH-10. Standard EPOCH-30 range is 10.000 to 99.999 Hz. EPOCH-10 full output power is available from 40 to 80 Hz. Beginning at 40 Hz, output power is linearly derated to 50% of output tap and 50% of output power at 20 Hz.)
- 60 Hz crystal controlled
- 50 Hz crystal controlled

Accuracy

- Synchronized, tracks input frequency
- Synchronized to EPOCH-30 ±10 ppm or 0.00006 Hz at 60 Hz
- ±0.006 Hz for 60 Hz crystal controlled (±0.01%)
- ±0.005 Hz for 50 Hz crystal controlled (±0.01 %)

Output Current: To meet a variety of test circuit impedances, three output ranges are provided. Only a single pair of output terminals is needed since impedance matching to the load is automatically performed by the microprocessor. Amplitude is adjusted by 4-digit, autoranging pushbutton control, with a large LED display of setting.

Ranges (auto-impedance matched)
0.00 to 25.00 A at 4 V max.
0.00 to 12.50 A at 8 V max.
0.000 to 3.125 A at 32 V max.

Resolution
Upper Two Ranges: 0.01 A
Low Range: 0.001 A

Rating: 100 VA

Duty Cycle: Continuous

Over-Range: A minimum of 20% amplitude over-range is available on each tap to reduce unnecessary tap changing and extend output capability. Duty cycle will vary with percent of over-range.

Accuracy
Typical: ±0.5% of setting or ±0.1% of range, whichever is greater

Maximum: ±1% of setting or ±0.1% of range, whichever is greater

Distortion: Less than 1% typical, 2% maximum

Alarm will indicate when amplitude, phase angle or waveform is in error.

Current Phase Angle Control: Angle is adjusted by 4-digit, pushbutton control, with large LED display of setting.

Range: 0.0 to 359.9°

Resolution: 0.1°

Accuracy: ±0.2° typical, ±0.5° max.

Output Voltage

Ranges (automatic range selection)
0.0 to 300.0 V at 0.25 A
0.0 to 150.0 V at 0.5 A
0.00 to 40.00 V at 0.25 A

Resolution
Upper Two Ranges: 0.1 V
Low Range: 0.01 V

Rating: 75 VA

Duty Cycle: Continuous

Over-range: The 150-volt range can be over-ranged up to 155-volt and the 300-volt range up to 310 V.

Accuracy
Typical: ±0.5% of setting or ±0.1% of range, whichever is greater
Maximum: ±1% of setting or ±0.1% of range whichever is greater.

Distortion: Less than 1% typical, 2% maximum

Alarm will indicate when amplitude, phase angle or waveform is in error.

Note: Accuracy may be greater than 1% for frequencies less than 40 Hz.

Regulation: Better than 0.5% (line/load)

Voltage Phase Angle Control: Angle is adjusted by 4-digit, pushbutton control, with large LED display of setting.

Range: 0.0 to 359.9°

Resolution: 0.1°

Accuracy: ±0.2° typical, ±0.5° max.

Temperature

Operating: 32 to 122° F (0 to 50° C)

Storage: –13 to +158° F (–25 to 70° C)

Dimensions

With Lids On
10.75 H x 21 W x 24.5 D in.
273 H x 533 W x 622 D mm

With Lids Off
10.75 H x 21 W x 18.5 D in.
273 H x 533 W x 470 D mm

Weight

With Lids On: 56 lb (25.5 kg)
With Lids Off: 50 lb (22.5 kg)

All EPOCHs (except the EPOCH-V) are housed in a rugged, polyethylene case custom-designed to withstand rugged field use.

ORDERING INFORMATION

Item	Cat. No.
EPOCH-10	
115-volt input	EPOCH-10-115/STD
IEEE interface and 115-volt input	EPOCH-10-115/IEE
230-volt input	EPOCH-10-230/STD
IEEE interface and 230-volt input	EPOCH-10-230/IEE
IEEE interface and 115-volt input without enclosure for rack mounting the unit	EP10-115/IEE/RK
IEEE interface and 230-volt input, without enclosure	EP10-230/IEE/RK
115-volt input, without enclosure	EP10-115/RK
230-volt input, without enclosure	EP10-230/RK

Item (Qty)	Cat. No.
Included Accessories	
Carrying case (1)	11436
Fuses: 10 A, 250-volt (5)	11333
Ground lead (1)	11258
Interconnect cable (1)	10838
Test leads	
Voltage (2 pr)	1282
Current (1 pr)	15922
Power cord (1)	6828
Instruction manual (1)	11987

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