

INSTRUCTION MANUAL

For

DYNAMIC FREQUENCY RELAY TEST SET

MODEL EPOCH-III

SERIAL NO.

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

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**MULTI-AMP MODEL EPOCH-III
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THEORY OF OPERATION

DIGITAL TIMER OPERATIONS

Control Functions:

This section of the instruction manual describes functions of all the controls, switches and binding posts associated with the use of the digital timer. The operating instructions give detailed instructions on the use of the timer in the succeeding section.

POWER ON/OFF Switch:	Used to energize the input of the EPOCH-III
TIMER DISPLAY:	Indicates elapsed time.
RESET Button:	Used to reset timer display to zero.
CYCLES/SECONDS Select Pushbutton:	Selects mode of count, either cycles or seconds. Selection can be made during or after timing operation.
START/STOP Selector Pushbuttons:	<p>Two independent start and stop gates are provided. The left pushbutton is used to select the start gate operating mode while the right pushbutton is used to select the stop gate mode. The following modes are provided for both the start gate and the stop gate;</p> <p>a) Dry Contact Closure (NO). Timer starts or stops at the closure of a normally open contact or upon conduction through a semiconductor device such as an SCR, triac or transistor.</p> <p>b) Dry Contact Open (NC). Timer starts or stops at the opening of a normally closed contact or when conduction through a semiconductor device such as an SCR, triac or transistor is interrupted.</p> <p>c) Application of AC or DC potential (AC/DC APPLIED). Timer starts or stops when an AC potential (3-200 volts RMS) or DC potential (5-300 volts) is applied.</p> <p>d) Removal of AC or DC potential (AC/DC REMOVED) Timer starts or stops when an AC potential (60-300 volts RMS) or DC potential (5-300 volts) is removed.</p>

e) **Internal Voltage Initiate.** Timer starts when voltage output is initiated.

f) **Internal Frequency Initiate.** Timer starts when the output frequency crosses the preselected frequency and stops if-and-when the same frequency is crossed again.

g) **Internal Sync.** Timer stops upon synchronization of EPOCH-III (variable frequency) and EPOCH-I (fixed frequency) sources.

START Binding Posts:

Binding posts used for applying of start signal to start operation of timer.

STOP/MONITOR Binding Posts:

The stop signal selected by the STOP selector switch is applied to these binding posts. The contact monitor and sensing circuitry is provided for use in observing the relay under test.

LATCHED ON/OFF Pushbutton:

This four function pushbutton is used in conjunction with the START/STOP Pushbuttons and the START/STOP binding posts to control the starting and stopping of the counter.

STOP LATCH:

When the STOP circuit is latched ON the stop latch allows timing to be stopped at the first operation of any stop gate (thus ignoring contact bounce, for example.) 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 then again stopped when the stop gate is again energized.

START LATCH:

When the START circuit is latched ON, the start latch allows timing to be initiated by any start gate and to be stopped only by the stop gate selected with the STOP selector pushbutton and applied at the STOP binding posts. When the START circuit is latched OFF the start latch allows timing to be initiated by any start gate and 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.)

MONITOR HORN ON/OFF Switch

The contact monitor and sensing circuitry is and CONTINUITY Lamp provided for use in observing the trip circuit of the relay under test. When the MONITOR circuit is used the timer is disabled.

The MONITOR Circuit follows the mode of the STOP Selector Switch. For example, with the STOP Selector Switch in the NO Dry Contact Close position and the HORN and CONTINUITY Switch in the ON position and the contact on the device under test is closed or the SCR is gated, the tone signal sounds and the CONTINUITY lamp glows. When HORN is in the OFF and the CONTINUITY is in the ON position, only the CONTINUITY Lamp glows on contact closure.

If the output of the test set is in the INITIATE position, the test set will de-initiate the output when the contacts of the device under test are closed or the SCR is gated. This can be useful when conducting timing tests or determination of instantaneous contact closure.

Timer Operating Instructions:

1. Connect the EPOCH-III to a suitable source of power.
2. Turn POWER ON/OFF Switch ON. The timer display should light.
3. Press the START selector pushbutton to the desired position for the start gate to be used.
4. Adjust the START LATCH ON/OFF switch to the desired position. If it is desired to use a separate stop gate to stop operation of the timer, switch the START LATCH ON mode. If it is desired to use the reversal of the START signal to stop the timer (as when timing the closing and opening of a single contact as in measuring the trip-free operating time of a circuit breaker), leave it in the LATCH OFF position.
5. When it is desired to use a separate stop gate signal to stop the timer, press the STOP selector to the desired position. Also press the stop LATCHED ON/OFF pushbutton to the desired position. If it is desired to have the timer stop upon the first stop signal only, switch the STOP LATCHED ON position. If it is desired to have the timer re-started if the stop signal reverses (as when measuring contact bounce) leave in the STOP LATCHED OFF position.
6. Press the SELECT CYCLES/SECONDS pushbutton to the desired mode. If the seconds mode is used, the timer will start in the 00.0001 range. As time accumulates the

timer will autorange up.

DESCRIPTION OF CONTROLS

This section of the instruction manual describes the function of all the various controls, switches, pushbuttons, binding posts, etc., which are located on the Multi-Amp® Model EPOCH-III™, less the Digital Timer Operations, which have already been discussed. All controls and output are clearly marked and logically grouped so that continual reference to the instruction manual should not be necessary after the operator has become acquainted with the operation of the test set as well as the test system.

The left section of the front panel is devoted to the power ON, initiate control, digital timer and contact monitor controls. The Digital Timer Operations and Monitor have been previously discussed.

Power/Master Initiate Switches

POWER ON/OFF Switch

Use to energize input to Model EPOCH-III's.

MASTER INITIATE Control Switch

INITIATE control circuitry to simultaneously energize or de-energize the output of the test set or outputs of one or more Model EPOCH-I™s when used. It is also used to start the dynamic frequency operation.

The MASTER INITIATE Switch is used in conjunction with the Output INITIATE Switch in the Voltage Section to control the operation of the test set (See description of this switch for further explanation).

When the EPOCH-III Voltage INITIATE switch or the Voltage and/or Current Output INITIATE switch(es) of EPOCH-I(s) are in the initiate position (red lamp(s) glowing) and the desired outputs are set with the pushbutton controls; when the MASTER INITIATE switch of the EPOCH-III is pressed, the appropriate outputs become energized, initiated. Once the test set is initiated, the outputs will remain energized until the MASTER INITIATE Control Switch is pressed again or until an operation is sensed by the MONITOR circuit on the EPOCH-III.

Also, pressing the output INITIATE Switch of the selected output channel will de-energize the output, however, repressing the selected output INITIATE switch will re-energize that output, as long as the MASTER INITIATE Control Switch is energized.

When interconnecting one or more Model EPOCH-I™(s), selected outputs of all units can be initiated from the EPOCH-III by pressing and releasing the MASTER INITIATE Control Switch. To de-initiate all initiated outputs on all units, simply press and release the MASTER INITIATE Control Switch on the EPOCH-III.

THERMAL OVERLOAD Lamp

To prevent damage to the voltage source power amplifier due to excessive heat overload, thermal overload circuitry is incorporated. Should the operator attempt to operate the output in excess of its rating for an extended length of time, the thermal overload circuitry will automatically de-energize the output on the test set. The display of the VOLTS channel will display "EEE" and the THERMAL OVERLOAD lamp will glow.

Fan operation will continue to provide the necessary cooling. If a thermal shutdown occurs, the operator must not switch POWER OFF so that the fan will continue to operate. After waiting several minutes for the unit to cool, the THERMAL OVERLOAD lamp will go out and operation of the test set can be resumed.

ON LINE Switch

When an EPOCH-I(s) is interconnected to the EPOCH-III this switch must be on in order for the units to operate together. When switched ON it forces all interconnected EPOCH-I's to the Slave Mode. When OFF the EPOCH-I's run independently of the EPOCH-III.

Frequency Section:

The center section of the front panel is devoted to the frequency output controls. The following is a description of each control and function.

CENTER DISPLAY	This 5 digit LED display works in conjunction with the FUNCTION Switch and FUNCTION Indicator Lamps. It can display Hertz, Seconds or Hertz per Second.
HERTZ Lamp	When lamp is glowing the above display is indicating frequency setting in Hertz.
SECONDS Lamp	When lamp is glowing the above display is indicating a time setting in seconds. When an infinite time is selected the word LONG will be displayed.
HZ/SEC Lamp	When lamp is glowing the above display is indicating the desired dynamic frequency change in Hertz per Second. When a step change in frequency is desired the word STEP will be displayed.
FUNCTION Switch	This switch is provided for selecting the desired Function. The following functions are provided: a) Normal Frequency. When lamp is glowing the center display is indicating the normal operating frequency set (usually 60.000 or 50.000 Hz). This is the frequency of the output voltage prior to initiating a dynamic test. b) Fault Frequency. When lamp is glowing the center display is indicating the desired Fault Frequency that the output will be changed to when test is initiated, see Dynamic Operations on page 18. c) Timer Start Frequency. When lamp is glowing the center display is indicating the frequency at which the TIMER will start, see Dynamic Operations on page 17. Note, the TIMER START has to be set to INTERNAL FREQ. for the timer to start at the preselected timer start frequency.

d) Duration. When lamp is glowing the center display is indicating the duration or time that the Fault Frequency will be maintained, see Dynamic Operations on page 17 for more details.

e) ΔF_1 . When lamp is glowing the center display is indicating the rate of change (delta rate) of the output frequency. Depending upon the selected Fault Frequency the delta may be up or down. The delta can be either a ramp or a step, see Dynamic Operations on page 17 for more details.

f) ΔF_2 . Same as ΔF_1 , however the delta rate does not have to be the same.

RESET Switch:

Used to reset to the beginning of the FUNCTION Sequence (output frequency is reset to NORMAL FREQ.). Resets the FIXED AND VARIABLE Frequencies to the in-phase condition. Master Initiate must be deinitiated in order to RESET.

INCREASE and DECREASE Pushbutton

The five-digit pushbuttons are used in conjunction with the FUNCTION Switch to select a desired frequency in hertz; a duration time in seconds, or a rate of change in hertz/second. When the FUNCTION Switch is in the Normal Frequency, Fault Frequency or Timer Start Frequency positions the first pushbutton on the left will raise or lower the output frequency in 10 hertz increments. The second pushbutton will increment in 1 hertz increments, the third .1, the fourth .01 and the fifth .001 hertz. Frequency range is 40.000 Hz to 79.999 Hz. When the FUNCTION Switch is in the Duration position the first pushbutton on the left will set the duration time to infinity. To reset Duration time from Long, press the left most Decrease pushbutton. The second pushbutton will set the duration time in 10 second increments. The third will increment in 1 second increments, the fourth 0.1 second increments and the fifth .01 second increments. The Duration Range is 0.000 to 99.99 seconds. when the

FUNCTION switch is set to F₁ or F₂ the first pushbutton on the left provides a step function or an instantaneous change in output frequency. To reset Step function, press the left most Decrease pushbutton. The second pushbutton from the left will increment the delta rate in 10 hertz/second, the third pushbutton will increment the delta rate at 1 hertz/second, the fourth .1 hertz/second, and the fifth .01 hertz/second. The delta rate range is 00.00 to 10.00 Hz/Sec.

Voltage Section:

The right section of the front panel is devoted to the voltage output controls. The following is a description of each of these controls.

HERTZ Display

This 5 digit LED display indicates the frequency of the voltage output.

VOLTS Display

This 4 digit LED display indicates amplitude of the voltage output.

INCREASE and DECREASE Pushbutton

The four-digit pushbuttons can increase or decrease the voltage output. When in the low range (TAP 1), 0 - 40.00 volts, the first pushbutton on the left will increase the output voltage in 10 volt increments. The second pushbutton will increment in 1 volt increments, the third from the left in .1 volt increments and the last pushbutton from the left (first from the right) will increment in .01 volt increments. When the output exceeds 39.99 volts, the output will autorange to TAP 2 (000.0 to 150.0 volts) and the decimal point will move to show a display of 40.0 volts. At this point the pushbuttons will change by a factor of 10, ie. the first pushbutton will now increment 100 volts, the second 10, the third 1 and the last .1 volts. With OUTPUT OFF and TAP LOCK OFF the test set will autorange from TAP 1 to TAP 2. With the output ON Autoranging will not occur between TAP 2 and TAP 3 until distortion is detected. The voltage output can be stepped as fast as the operator can press, release, and press again; or by pressing and holding in the pushbutton the output will automatically ramp up or down at a rate of two digits per second.

ON/OFF Switch and Lamp

This switch is provided for use in controlling the voltage output. In the OFF position, the potential output is OFF regardless of the position of the MASTER INITIATE Control Switch.

In the ON position, the voltage output is energized regardless of the position of the MASTER INITIATE Control Switch. When the indicating lamp is ON, the output is energized.

TAP LOCK Switch

To avoid unnecessary auto tap changing during manual operation, i.e. test voltages slightly greater than 40.00 volts, by pressing the TAP LOCK switch, a given output tap will lock into position and will not autorange.

INITIATE Switch and Lamp

When the voltage output INITIATE Switch is pressed, and the indicating lamp is glowing, the MASTER-INITIATE Control Switch must be pressed to turn the voltage output on and off.

Red and COM White

Provides for connection to voltage output. The COM White Binding Post is grounded and should be used as the instantaneous polarity terminal with the Red terminal as non-polarity.

Error Indication and Alarm

Circuitry is incorporated to indicate whenever the amplitude, waveform of the voltage source is in error. When the error is detected, the amplitude display will flash, the alarm will sound and the output voltage will turn off.

Back Panel:

The programmable AC input cord socket, ground terminal, interconnecting plugs, 50 Hz/60 Hz selector, and IEEE-488 bus connection (optional feature) are mounted on the back of the test set. The following is a description of each item.

Input Cord and Safety

A line cord with a standard three-pronged grounded plug is Ground (removable) provided for connection of the test set to a suitable input power source.

When using one or more EPOCH-I's with the EPOCH-III, it is necessary to connect all units to a suitable input power source using the line cords provided. Additionally, for proper operation of the test system, it is necessary to connect all the ground terminal on the back panels together. Leads are provided for this purpose.

FIXED and VARIABLE

When combining one or more EPOCH-I's with the EPOCH-FREQUENCY Interconnects III to form a test system, it is necessary to properly interconnect the system using the ribbon connector. The EPOCH-III can provide a FIXED and VARIABLE frequency reference for up to three EPOCH-I's on each interconnect simultaneously. See details under Use of EPOCH-III with one or more EPOCH-I's beginning on page 12.

IEEE-488 (GPIB Optional)

The optional General Purpose Interface Bus (GPIB) enables the EPOCH-III to function as a talker-listener with any controller or computer with conforms to the IEEE-488 Bus connector.

50/60 HZ Select Switch

This switch is used to select the Fixed reference frequency for the EPOCH-III and all interconnected EPOCH-I's. Additionally, it sets the time base for the timer.

115/230V Select Switch

This switch is used to select the input line voltage. It is incorporated in the programmable cord socket.

Fuse Holders

Two fuses are located inside the input cord socket. An 8A fuse (115V) and a 4A fuse (230V) are accessible by removing the Input Cord, insert a screw driver in the slot on the top of the socket and pry open.

INITIAL SET-UP

Unpack the EPOCH-III and check for any evidence of shipping damage. If visual damage is present, notify freight carrier to make damage claims. Also, notify the factory. The covers are easily removable for access to the front and back panels.

CAUTION: Potentially lethal voltage can be present on the output terminals. It is recommended that the operator thoroughly read the instruction manual and understand the operation of the test set before energizing. An operational check may be performed as follows to verify that the amplitude, frequency, timer, initiate controls, and monitor circuits are functioning properly.

1. Before plugging in unit, make sure the POWER ON/OFF switch is OFF.
2. Plug the line cord into a suitable source of power, as indicated on the input voltage socket (on the back panel) and switch the POWER ON/OFF switch ON.
3. It is recommended that the voltage amplitudes and frequency controls be checked using external instrumentation before placing unit in service.
4. To check the contact monitor tone generator, switch the MONITOR HORN ON/OFF and CONTINUITY Lamps ON. Jumper the red STOP/MONITOR binding posts. The tone signal should sound and the CONTINUITY lamp should glow. Switch the STOP Select Pushbutton to VOLTAGE APPLIED position, and remove the jumper, connect the VOLTAGE Output Binding posts to the STOP/MONITOR binding posts.
5. To check the 5 to 250V sensing circuitry, set an appropriate voltage, ie. 10 volts, by pressing the VOLTAGE, INCREASE pushbuttons, and turn the VOLTAGE Output ON by pressing the VOLTAGE ON/OFF Pushbutton. The tone signal should sound, and the CONTINUITY lamp should glow. Switch Voltage OFF. Remove leads from STOP/MONITOR binding posts.
6. Check to insure the output is OFF. Connect the appropriate instruments to the voltage output binding posts. By pressing the INCREASE pushbuttons set a suitable voltage and frequency output, observe the LED displays for amplitudes. Press the voltage INITIATE switch, lamp should glow, however, there should be no output yet. Press the MASTER INITIATE Control Switch and release, output should energize. Press the MASTER INITIATE Control Switch again and release, the output should de-energize.
7. To verify operation of the INTERNAL VOLTAGE timer start circuitry, switch the TIMER START SELECT switch to VOLTAGE; VOLTAGE lamp should glow. The voltage INITIATE switch lamp should still be glowing from the test conducted in step 6. If not, press the voltage INITIATE switch, lamp should be glowing now. Press the MASTER INITIATE Control Switch and release, the output should be energized, and the timer should start. Press the MASTER INITIATE Control Switch to de-initiate the output.
8. To verify proper operation and calibration of the Frequency Section and Timer Section see SERVICE DATA, Self Diagnostic Test on page 32.

USE OF EPOCH-III WITH ONE OR MORE EPOCH-I's

EPOCH-III, Master Unit:

When performing tests which require interconnection of one or more Model EPOCH-I test sets, it is necessary to set up the EPOCH-III as a master unit, so that all outputs have the same frequency and phase references for correct phase angle relationships. Additionally, the system is initiated through the master unit, the EPOCH-III.

Incorporated on the back panel of each EPOCH-I is an interconnecting socket. On the back panel of the EPOCH-III are two interconnecting sockets, one a FIXED Frequency and the other a VARIABLE Frequency. If it is desired that the interconnected EPOCH-I's follow the variable frequency output of the EPOCH-III, connect to the VARIABLE socket; otherwise connect to the FIXED. A long interconnecting cable with matching plugs is provided for making the interconnection. To make the interconnection, proceed as follows:

1. To conserve work space, each Model EPOCH-III and EPOCH-I is designed to stack one on top of another. Although it is not necessary, it is suggested that the operator stack the units together.
2. It is further suggested that the operator stack the EPOCH-III on top (MASTER). This will assist in eliminating confusion when making three-phase, 3 or 4 wire connections to the relay under test.
3. Locate the long interconnecting cable equipped with three plugs. Connect one end of the long three plug cable into the EPOCH-III FIXED or VARIABLE socket. Connect the other plugs into the EPOCH-I interconnect sockets. For units equipped with IEEE-488 GPIB connect units together using the appropriate GPIB interconnect cable. The connectors are keyed and will only go on one way.
4. When using three test sets, interconnect the middle Model EPOCH-I unit by plugging the second longest cable into the socket on the middle unit and interconnect the bottom Model EPOCH-I unit by plugging the longest cable into the socket on the bottom unit. This connection connects each test set to the ac reference in the EPOCH-III. Additionally, all three units must have a common ground connection. To ensure a common ground, connect the ground winged studs on the back panel of each unit together with the cables provided.

Plug each unit into a suitable source of input power. The test system is now ready for operation. Failure to make the above interconnection correctly (including ground connections) can result in improper operation of the test system.

Spare interconnecting cables are provided when the test sets are shipped from the factory. If the interconnecting cables are lost, additional cables are available from the factory.

5. After turning the test sets ON, press the EPOCH-III ON LINE switch (this makes the EPOCH-I's slave to the EPOCH-III).

Setting Phase Angle Relationships:

Each EPOCH-I has an internal zero reference to which it references its phase angle settings, as displayed on the LED readouts. This applies to phase angle settings between the voltage and current outputs of one EPOCH-I or between any combination of voltages and/or currents of two or more units. Since the EPOCH-III is always the MASTER unit, its voltage output is always zero degrees reference, and all interconnected EPOCH-I's are referenced to it. For details on setting phase angles on EPOCH-I's see "Setting PHASE ANGLE RELATIONSHIPS" on page 2-14 of the EPOCH-I instruction manual.

Voltage Sources - Outputs Summed Together:

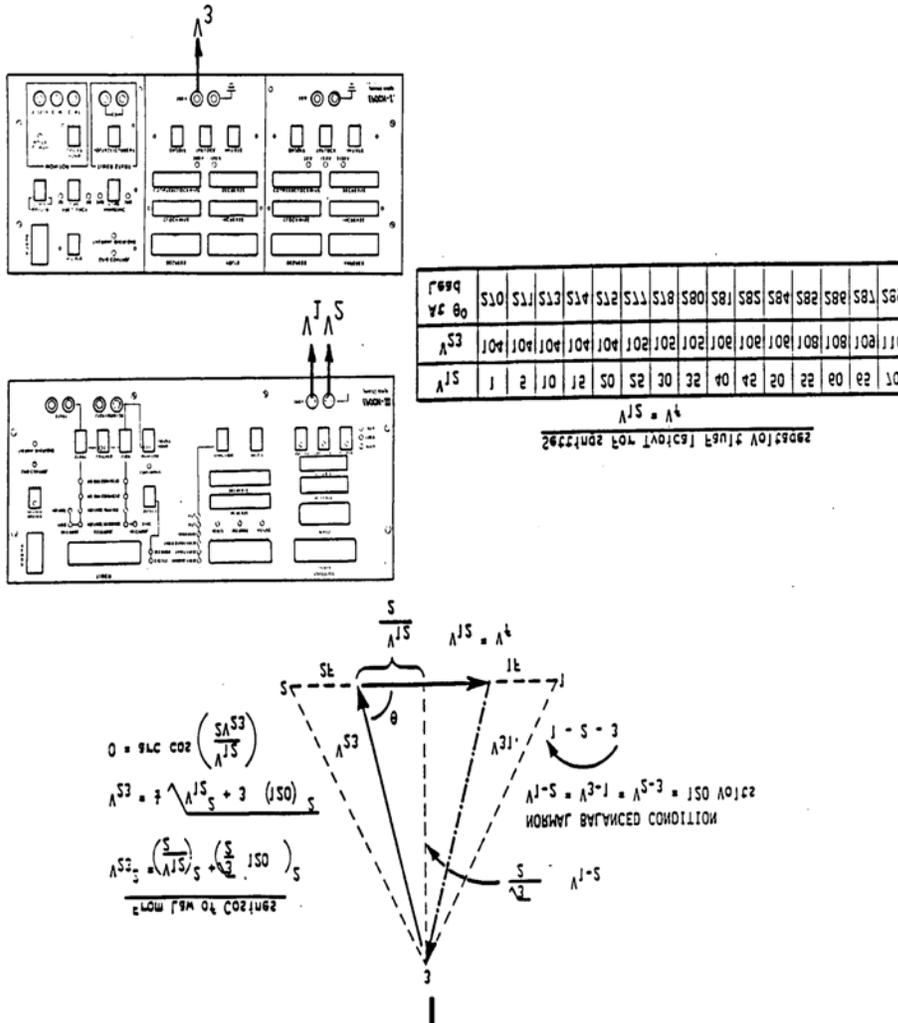
The Model EPOCH-III and one Model EPOCH-I may be used to sum voltage outputs to obtain higher than rated voltage provided the load is not grounded. With test sets properly interconnected together, simply connect load between two red binding posts and set the EPOCH-I PHASE ANGLE control to 180 degrees. The output will now directly add and the amplitude will be the sum of the two amplitudes displayed on the VOLTAGE amplitude displays. Note that the white common terminals are grounded and not used.

Voltage Sources - Dynamic Voltage Relay Test:

Over/Under Voltage Relays can be dynamically tested using the Model EPOCH-III and one Model EPOCH-I Test Sets. This procedure applies a "normal" voltage to the relay under test and then automatically adjusts the test voltage to a "fault" amplitude either higher for testing over voltage relays or to a lower voltage for testing under voltage relays. Additionally, the EPOCH-III timer is started coincident with "fault" voltage. For detailed test procedures see Table of Contents for listing of individual relays.

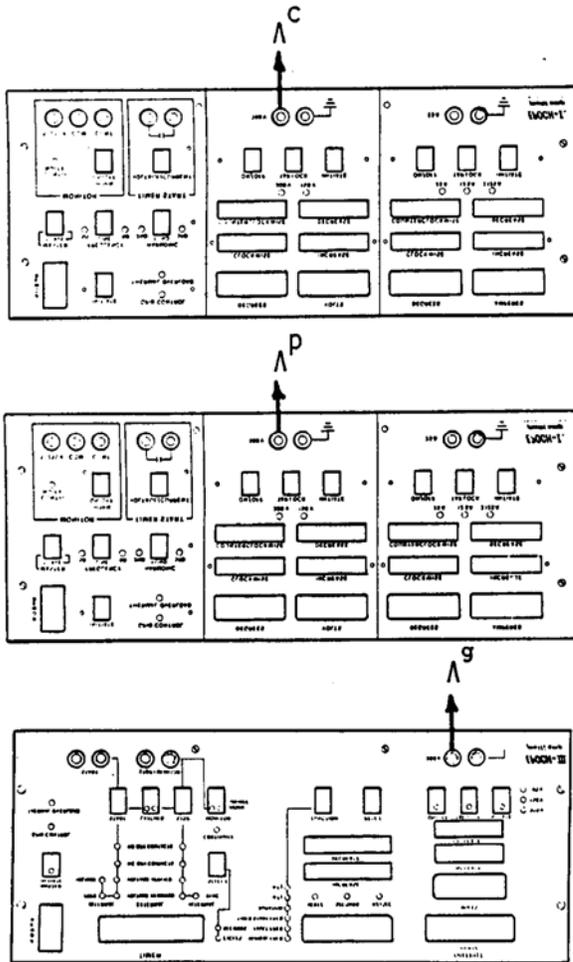
Voltage Source - 3Ø3 - Wire, Open Delta:

When using the Open-Delta Configuration to set up a phase-to-phase fault, calculations using the Law of Cosines is required to calculate amplitudes. When setting up an unbalanced Open-Delta configuration, the desired phase-to-phase fault voltage, V_{12} is set using the EPOCH-III unit. Phase-to-phase voltage V_{23} and its phase angle relationship must then be calculated using the Law of Cosines $V_b^2 = V_a^2 + V_c^2 - 2V_aV_c \cos B$. Figure 2 shows the phase relationships and an example of the necessary calculation. For user convenience, the amplitude and phase angle settings for typical fault magnitudes are tabulated.

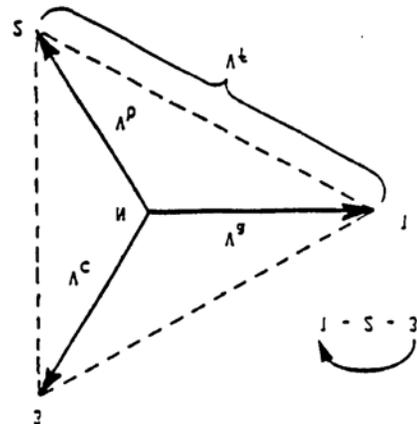


Voltage Source - 3Ø, 4-Wire, Y-Connection:

A three-phase, four-wire potential system can be provided using one EPOCH-III and two Model EPOCH-I test sets. The vector relationships are shown in Figure 3. This Y-Connection has the advantage of being able to supply higher line to line voltage (1.73 x phase-to-neutral voltage) and is ideally suited for simulating phase to ground faults. To eliminate confusion, again, it is suggested the three test sets be stacked and the top unit be the EPOCH-III, and its voltage source designated as V_a . The center test set is then designated as V_b and phase angle set for 120 degrees. Finally, the lower unit is designated V_c and phase angle set for 240 degrees. V_a , V_b and V_c are then connected to the red potential binding posts on the respective test sets. If a neutral is required, it is connected to a white potential section binding post on any test set to ground the load.



$$\begin{aligned} \Lambda^C &= \frac{2}{\sqrt{3}} & \Lambda^t &< 300 \\ \Lambda^P &= \frac{2}{\sqrt{3}} & \Lambda^t &< 150 \\ \Lambda^g &= \frac{2}{\sqrt{3}} & \Lambda^t &< 0 \\ \Lambda^t &= 0621469 \text{ } \end{aligned}$$

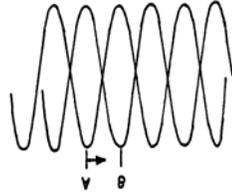


Testing Sync-Check, Synchronizing and Auto-Synchronizing Relays:

To perform tests on synchronizing type relays requires the use of one Model EPOCH-III and one Model EPOCH-I, to supply the two required voltage sources, phase shift and slip frequencies. The EPOCH-III is the Master Unit and the EPOCH-I is the Slave.

Pick-Up or Closing Angle Tests - To perform pick-up or closing angle tests, the EPOCH-III voltage is zero degree reference and the EPOCH-I voltage channel provides the variable phase angle adjustment. Remember the phase angle indicated on the EPOCH-I is a lagging angle. For example, if the relay's closing characteristic is 20 degrees leading, set an angle of 340 degrees on the EPOCH-I.

Setting Advance Time - To perform this test, the EPOCH-III will provide the variable slip frequency (generator) and the EPOCH-I will provide the-fixed voltage, frequency source (bus). With the EPOCH-I and EPOCH-III voltages set to the appropriate levels set the appropriate slip frequency output on the EPOCH-III ie. 60.050 Hz. Set the Timer Stop to Internal Sync. Set the Timer Start to start off the relays' close signal to the circuit breaker. Reset the EPOCH-III by pressing the RESET pushbutton. With EPOCH-I output ON and the EPOCH-III output in the INITIATE position, when the EPOCH-III MASTER INITIATE Pushbutton is pressed, the EPOCH-III output is applied to the relay at the desired slip frequency. When the relay sends a close signal the timer will start, upon synchronization of the two outputs the timer will stop. The time indicated on the timer is the advance time setting of the relay. To repeat the test, deinitiate the EPOCH-III by pressing the MASTER INITIATE pushbutton and press the RESET pushbutton. Press the MASTER INITIATE pushbutton to repeat.



A - EPOCH-III SLIP FREQUENCY

B - EPOCH-I FIXED FREQUENCY

As "A" approaches "B", at some point (the advanced angle) the relay will send a close signal, which will start the EPOCH-III timer. When "A and B" are in synchronous, the EPOCH-III timer will stop. The time indicated on the timer display is the Advance Time, which should equal the closing time of the circuit breaker.

DYNAMIC OPERATION

The EPOCH-III can be programmed from the panel to perform dynamic timing test on all under/over frequency relays either electro-mechanical or solid-state, single or multi-set-point. To test a typical multi-setpoint, solid-state under frequency relay, the following procedure applies.

1. With the relay properly connected to the test set output terminals and the EPOCH-III turned on, set the Normal Line Frequency and Voltage using the INCREASE pushbuttons. Read the frequency and voltage selected on the appropriate digital displays.
2. Press the FUNCTION Selector Switch. Set the desired Fault Frequency by pressing the Frequency Section INCREASE pushbuttons. This is the frequency that the output will delta or step down to.
3. Press the FUNCTION Selector Switch. Set the desired Timer Start Frequency. If using a ramping frequency output, when the output frequency ramps through the Timer Start Frequency the timer will start. If using a Step Function the Timer Start Frequency must be equal to the fault Frequency.
4. Press the FUNCTION Selector Switch. Set the Duration time by pressing the INCREASE pushbuttons on the Frequency Section, time indicate is in seconds. This time is the desired time at which the output frequency will remain at the Selected Fault Frequency. If the operating time of the relay is unknown, the duration Time can be set infinitely long by pressing the left most INCREASE pushbutton on the Frequency Section.
5. Press the FUNCTION Selector Switch. Set the $\underline{\quad}$ F₁ rate of change. For example, if you wish to ramp the output frequency at .1 hertz per second, then press the appropriate INCREASE pushbutton on the Frequency Section until 00.10 HZ/Sec is displayed. However, if you desire to step the frequency, press the left most INCREASE pushbutton and STEP will be displayed.
6. Press the FUNCTION Selector Switch. Set the $\underline{\quad}$ F₂ rate of change similarly to the $\underline{\quad}$ F₁. A different rate maybe selected from that of $\underline{\quad}$ F₁. A step function may also be selected.
7. Press the Reset pushbutton. Select the Timer Start gate to start on INTERNAL FREQUENCY Initiate. With the relay trip circuit connected to the STOP gate binding posts, select the appropriate Timer Stop gate.

Press the Timer Start/Stop LATCHED ON pushbutton to LATCH both the START and STOP circuits. NOTE: Failure to LATCH circuits will result in timing error.

8. Press the Voltage Output INITIATE pushbutton. Press the MASTER INITIATE pushbutton. The voltage output frequency will begin to delta (or step) down. When the relay trip signal is

sensed, the output will deinitiate and the timer will stop indicating the trip time.

TESTING UNDER/OVERFREQUENCY RELAYS

Westinghouse type CF-1

General Electric type IJD

GENERAL

The General Electric IJD and Westinghouse type CF-1 are electro mechanical induction disc type frequency relays. They are used to protect motors or generators against over or underspeed conditions, due to loss of power or load.

Prior to switching the test set on, there are no preliminary set-up of controls. Upon the initial powering up of the test set, all controls automatically reset to zero or off conditions.

ALWAYS REFER TO THE MANUFACTURERS LITERATURE BEFORE TESTING

TYPES OF TESTS

Pick-up

Timing

Pick-up Test

1. Connect the EPOCH-III test set to a suitable source of power as indicated on the programmable AC input cord socket. Check to insure the POWER ON/OFF switch is OFF.
2. Connect a light set of leads from the red STOP/MONITOR binding posts to the trip circuit contact terminals of the relay induction unit.
3. Connect the relay operating coil to the red and white potential output binding posts of the Model EPOCH-III.
4. Switch POWER ON/OFF switch ON. Switch the MONITOR HORN and CONTINUITY switch ON.
5. Press the voltage OUTPUT ON/OFF switch to turn the voltage channel ON.
6. Increase the voltage output until the relay's rated voltage (as indicated on the nameplate of the relay) is indicated on the VOLTS display.
7. Adjust the frequency output by pressing the appropriate frequency section INCREASE or DECREASE pushbutton until the relay's contacts just close and the CONTINUITY light flickers and/or the tone signal breaks. Read and record the pick up frequency as indicated on the HERTZ display.

TIMING TEST

NOTE: Refer to page 17 on Dynamic Operation of the EPOCH-III frequency output. To perform a

timing test on induction disc frequency relays requires a STEP Function.

1. If you have just completed the pick up test continue to step 2, otherwise repeat steps 1 through 6 of the PICK UP Test.
2. Set the Normal Line Frequency using the INCREASE Pushbuttons in the Frequency Section. Read the frequency on the FUNCTION and OUTPUT displays.
3. Press the FUNCTION Selector Switch. The FAULT FREQ. lamp should be lit. Set the desired Fault frequency by pressing the Frequency Section INCREASE (overfrequency) or INCREASE (underfrequency) pushbuttons. This is the frequency that the output will step up or down to.
4. Press the FUNCTION Selector Switch. The TIMER START FREQ. lamp should be lit. Set the timer to start at the same frequency as the FAULT FREQUENCY (When using a step Function the Timer Start Frequency must be equal to the Fault Frequency).
5. Press the FUNCTION Selector Switch. The DURATION lamp should be lit. Set the DURATION Time by pressing the INCREASE pushbuttons on the Frequency Section, time indicated is in seconds. This time is the desired time at which the output frequency will remain at the selected Fault Frequency. For typical induction disc relays, an infinite time can be set by pressing the left most INCREASE pushbutton on the Frequency Section.
6. Press the FUNCTION Selector Switch. The F_1 lamp should be lit. For these relays a ramp function is not required, instead a step function should be used. To set a Step Function press the left most INCREASE Pushbutton on the Frequency Section, STEP will be displayed.
7. Since we are performing a simple timing test on an induction disc relay it will not be necessary to set F_2 . Therefore, press the RESET pushbutton. Select the Timer Start gate to start on INTERNAL FREQ. Initiate. With the relay trip circuit connected to the STOP gate binding posts, select the appropriate Timer Stop gate (usually N.O. DRY CONTACTS). Press the Timer Start/Stop LATCHED ON pushbutton to LATCH both the START and STOP circuits. NOTE: Failure to LATCH circuits will result in timing error.
8. Press the Voltage Output INITIATE Pushbutton. Press the MASTER INITIATE Pushbutton. The voltage output frequency will step up or down (over or under frequency). When the relay trip signal is sensed, the output will deinitiate and the timer will stop indicating the trip time.
9. To repeat the test, simply press the RESET pushbutton. Press the Voltage Output ON/OFF and INITIATE switches ON. Press the MASTER INITIATE switch again. After completion of tests, turn test set OFF.

TESTING SOLID-STATE OVER/UNDERFREQUENCY RELAY

Basler type BE1-81.0/U

GENERAL

The following test procedure is intended as a field service test, where tests are performed to insure proper operation at in-service settings. To perform acceptance tests see Basler Electric Publication Number 9 1373 00 990.

Prior to switching the test set on, there are no preliminary set-up of controls. Upon the initial powering up of the test set, all controls automatically reset to zero or off conditions.

ALWAYS REFER TO THE MANUFACTURERS LITERATURE BEFORE TESTING

TYPES OF TESTS

Pick-Up
Timing
Undervoltage Inhibit

PICK-UP TEST

1. Connect the EPOCH-III test set to a suitable source of power as indicated on the programmable AC input cord socket. Check to insure the POWER ON/OFF switch is OFF.
2. Connect a light set of leads from the red STOP/MONITOR binding posts to the trip circuit contact terminals of the relay, ie. terminals 1 and 10 for SETPOINT 1.
3. Connect an appropriate AC or DC voltage source to relay terminals 3 and 4. For relays with the AC or DC source option the AC output of the EPOCH-III can be paralleled to provide source voltage if a separate voltage source is not available, however, this will prohibit performing the Undervoltage Inhibit test.
4. Connect the relay frequency sensing circuit (normally relay terminals 6 and 7) to the red and white potential output binding posts of the Model EPOCH-III.
5. Switch the POWER ON/OFF switch ON.
6. Increase the voltage output until the relays rated voltage is indicated on the VOLTS display.
7. Press the voltage OUTPUT ON/OFF switch to turn the voltage channel ON
8. Set the relay's TIME DELAY selector to 02 for timing type E1 or 0.1 for timing type D1.
9. Adjust the frequency output by pressing the appropriate frequency section INCREASE or DECREASE pushbuttons until the relay's PICK UP lamp just lights. Read and record the pick up frequency.

10. Reset output frequency to normal.

11. Reset relay's TIME DELAY selector to original setting.

TIMING TEST

NOTE: Refer to page 17 on Dynamic Operation of the EPOCH-III frequency output. To perform a timing test on the relay requires a STEP Function.

1. If you have just completed the Pick Up Test continue to step 2, if not complete steps 1 through 7 of the Pick Up Test.
2. Press the FUNCTION Selector Switch. Set the desired Fault Frequency by pressing the Frequency Section INCREASE pushbuttons. This is the frequency that the output will step down to.
3. Press the FUNCTION Selector Switch. Set the desired Timer Start Frequency. Since a Step Function will be used, the Timer Start Frequency must be equal to the Fault Frequency.
4. Press the FUNCTION Selector Switch. Set the Duration Time by pressing the Increase pushbuttons on the Frequency Section, time indicated is in seconds. The time set is the time at which the output frequency will remain at the Fault Frequency.
5. Press the FUNCTION Selector Switch. Set a Step Function for F_1 by pressing the left most INCREASE pushbutton in the frequency section.
6. Press the FUNCTION Selector Switch. Set the desired F_2 rate of change by pressing the Frequency Section INCREASE pushbuttons. If a Step function is desired press the left most pushbutton.
7. Select the Timer Start gate to start on INTERNAL FREQ. Initiate. Select the appropriate Timer Stop gate (usually N.O. DRY CONTACTS). Press the RESET pushbutton. Press the Timer Start/Stop LATCHED ON pushbutton to LATCH both the START and STOP circuits. NOTE: Failure to LATCH circuits will result in timing error.
8. Press the Voltage Output INITIATE pushbutton to the INITIATE position. Press the MASTER INITIATE Pushbutton. The voltage output frequency will step change. When the relay trip signal is sensed, the output will deinitiate and the timer will stop indicating the trip time. The trip time should be equal to the TIME DELAY + 1 cycle for E1 (definite time delay) or 5% of characteristic curve plus 3 cycles of the sensed frequency for DI (Inverse time delay).

UNDERVOLTAGE INHIBIT TEST

- 1. Repeat steps 1 through 7 of the Pick Up Test.**
- 2. Slowly decrease voltage output until the relay's Under Voltage Inhibit lamp glows.**
- 3. Switch voltage output OFF by pressing the OUTPUT ON/OFF switch to OFF.**
- 4. This completes the tests, turn test set off.**

TESTING SYNCHRONISM-CHECK RELAY **General Electric Type IJS**

GENERAL

The IJS relay is used to verify synchronism between two sources, and allow the closure of a circuit breaker when the two sources are correctly synchronized.

To test this relay requires the use of one Model EPOCH-III and one Model EPOCH-I.

Prior to switching the test set on, there are no preliminary set-up of controls. Upon the initial powering up of the test set, all controls automatically reset to zero or off conditions.

ALWAYS REFER TO THE MANUFACTURERS LITERATURE BEFORE TESTING

TYPES OF TESTS

Pick-up (Closing Angle)

Timing

PICK-UP TEST

1. Connect the EPOCH-III and EPOCH-I test sets to a suitable source of power as indicated on the programmable AC Input cord sockets (EPOCH-III) or nameplate (EPOCH-I) check to insure the POWER ON/OFF switches are OFF.

NOTE: Refer to page 12 on selection of EPOCH-III Master Unit and page 16 for explanation on the testing of Sync-Check and Synchronizing relays.

2. With the EPOCH-III and EPOCH-I test sets correctly interconnected, switch the POWER ON/OFF switches ON. Press the EPOCH-III ON LINE switch.

Connect a set of light leads from the EPOCH-III red and white output binding posts to one potential coil.

4. Connect a set of light leads from the EPOCH-I red and white output binding posts to the other potential coil.
5. Connect a set of light leads from the red STOP/MONITOR binding posts to the trip circuit contact terminals of the relay, usually relay terminals 1 and 2.
6. Increase the voltage outputs of both voltage channels until rated voltage is applied to both potential coils.
7. Press the voltage OUTPUT ON/OFF switches to turn the voltage channels ON. Switch the MONITOR HORN and CONTINUITY switch ON. The relay contacts should close, the CONTINUITY

lamp should glow and the tone signal should sound.

- 8. Rotate the EPOCH-I voltage output phase angle to find the closing angles, by pressing the CLOCKWISE and COUNTERCLOCKWISE pushbuttons. When the CONTINUITY lamp flickers or the tone signal breaks, read and record angles ie. 20° lag and 340° lag (20° lead).**
- 9. Switch voltage outputs OFF by pressing the voltage channels ON/OFF switches.**

TIMING TEST

- 1. If you have just completed the pick-up test, continue to step 2, otherwise repeat steps 1 through 6 under Pick Up Test.**
- 2. Adjust the phase angle on the EPOCH-I voltage channel to zero degrees.**
- 3. Switch the EPOCH-I OUTPUT ON/OFF switch ON.**
- 4. On the EPOCH-III, press the voltage channel INITIATE switch to the INITIATE position.**
- 5. Select the Timer Start gate to start on INTERNAL VOLTAGE Initiate. With the relay trip circuit connected to the STOP gate binding posts, select the appropriate Timer Stop gate (usually N.O. DRY CONTACTS).**
- 6. Press the RESET pushbutton. Check to insure relay is in de-energized position.**
- 7. Press the MASTER INITIATE Pushbutton. The voltage output will turn on, the timer should start. When the relay operates the test set should deinitiate and stop timing.**
- 8. To repeat the test, simply press the RESET pushbutton and press the MASTER INITIATE pushbutton.**
- 9. After completion of tests, return outputs to zero and turn test sets OFF.**

TESTING SYNC-CHECK RELAY
Basler Type BE1-25

GENERAL

The Basler BE1-25 relay is used to sense synchronism between two voltage sources, verify that the voltage and phase difference is within limit, and after a preselected time period allow the "sync" output relay to energize.

To test this relay requires the use of one Model EPOCH-III and one Model EPOCH-I.

Prior to switching the test sets on, there are no preliminary set-up of controls. Upon the initial powering up of the test set, all controls automatically reset to zero or off conditions.

~~ALWAYS REFER TO THE MANUFACTURERS LITERATURE BEFORE TESTING~~

~~TYPES OF TESTS~~

~~Pick-Up (phase angle detection)~~

~~Minimum Voltage~~

~~Voltage Difference (V)~~

~~Timing~~

~~PICK-UP TEST~~

1. ~~Connect the EPOCH-III and EPOCH-I test sets to a suitable source of power as indicated on the programmable AC input cord socket (EPOCH-III) or Nameplate (EPOCH-I). Check to insure the POWER ON/OFF switches are OFF.~~

~~NOTE: Refer to page 12 on selection of EPOCH-III Master Unit and page 16 for explanation on the testing of Sync-Check relays.~~

2. ~~With the EPOCH-III and EPOCH-I test sets correctly interconnected, switch the POWER ON/OFF ON. Press the EPOCH-III ON LINE Switch.~~
3. ~~Connect the EPOCH-III and EPOCH-I to the relay per Figure A on page 28. Refer to NOTES 1 and 2. If the relay has non-isolated sensing input circuit a DC voltage must be applied to terminals 14 and 15, observe polarity. If the relay has the option of either AC or DC power supply voltage, jumper relay terminals 3 to 6 and 4 to 7.~~
4. ~~Increase the voltage outputs of both voltage channels until rated voltage is set for both voltage sensing circuits.~~
5. ~~Set the relays' time delay to 1.~~

6. Press the voltage OUTPUT ON/OFF switches to turn the voltage channels ON.
7. Rotate the EPOCH-I voltage output phase angle to find the pick up of the closing angle. Press the CLOCKWISE and COUNTERCLOCKWISE pushbuttons to increase and decrease phase angle. When the PHASE ANGLE LED flickers read and record angles, ie. 45° lag and 315° lag (45° lead).
8. Return the phase angle to zero degrees, and switch the voltage outputs

MINIMUM VOLTAGE TEST

1. If you have just completed the Pick Up Test continue to step 2, if not complete steps 1 through 6 under Pick Up Test.
2. Press the voltage OUTPUT ON/OFF switches to turn the voltage channels ON. The relays' POWER PHASE ANGLE and SYNC lamps should be lit.
3. Lower the EPOCH-I voltage output by pressing the DECREASE pushbuttons until the VOLTS display indicates 30.0 volts. The DL lamp should be lit. The PHASE ANGLE and SYNC lamps should not be lit.
4. Increase the EPOCH-I voltage output by pressing the INCREASE pushbuttons until the LL lamp lights. The PHASE ANGLE lamp should also be lit. Read record minimum voltage pick up (normally 80 Vac).
5. Increase the EPOCH-I voltage output to rated voltage and repeat the test by lowering the EPOCH-III voltage output. At approximately 30 volts AC the DB lamp should glow and the PHASE ANGLE and LB lamps should not be lit. At approximately 80 VAC the LB and PHASE ANGLE lamps should glow, read and record minimum voltage pick up. Return the EPOCH-III output voltage to the relays rated voltage level.
6. Switch the voltage channels OFF.

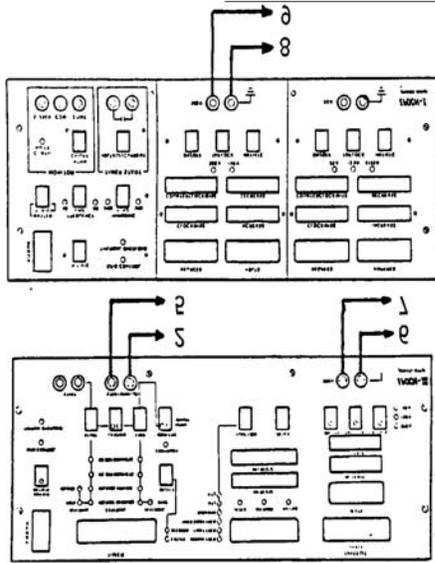
VOLTAGE DIFFERENCE (___ V) TEST

1. If you have just completed the Minimum Voltage Test continue to step 2, if not complete steps 1 through 6 under Pick Up Test.
2. Press the voltage OUTPUT ON/OFF switches to turn the voltage channels ON.
3. Lower the EPOCH-I voltage output to 80 volts. Slowly increase the voltage until the ___ V lamp glows. Read and record voltage. The ___ V value is the difference between the EPOCH-III and EPOCH-I voltages.

4. Return the EPOCH-I output voltage level to the relay's rated voltage. Reset the relay's time delay setting. Switch voltage output channels ON/OFF switches OFF.

TIMING TEST

1. If you have just completed the Voltage Difference test continue to step 2, otherwise complete steps 1 through 4 under Pick Up Test.
2. If needed, adjust the phase angle on the EPOCH-I voltage channel to zero degrees.
3. Switch the EPOCH-I OUTPUT ON/OFF switch ON.
4. On the EPOCH-III, press the voltage channel INITIATE switch to the INITIATE position.
5. Select the timer Start gate to start on INTERNAL VOLTAGE Initiate. With the relay trip circuit connected to the STOP gate binding posts, select the appropriate Timer Stop gate (N.O. DRY CONTACTS).
6. Press the FUNCTION switch. The FAULT lamp should be lit, set normal frequency for fault frequency and FUNCTION display. Reset the timer and FUNCTION display by pressing the RESET pushbutton.
7. Press the MASTER INITIATE Pushbutton. The EPOCH-III voltage output will turn on and the timer should start. When the relay operates the test set should deinitiate and stop the timer.
8. To repeat the test, simply press the RESET pushbutton and the MASTER INITIATE pushbutton.
9. After completion of tests, return outputs to zero.



- ▽ If non-isolated sensing input is installed, voltage source must be supplied. Otherwise, install jumper to simulate breaker open signal.
- ▽ Appropriate AC or DC operating voltage for relay is indicated on terminal with AC or DC symbol. Terminals 3 and 4 are 120V.

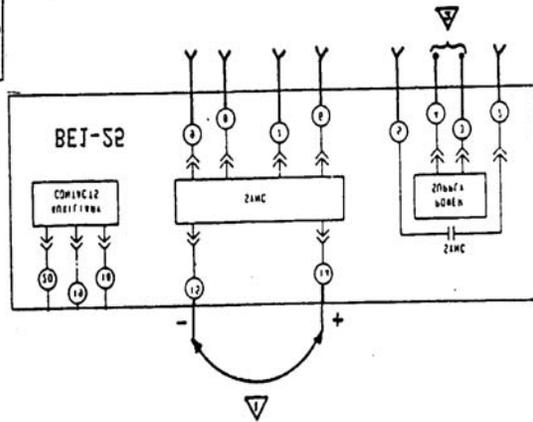


FIGURE A: Test connections for testing Basler Electric Type BE1-25

TESTING UNDER/OVER VOLTAGE RELAYS
Westinghouse Type CV
General Electric Type IAV

GENERAL

The voltage relay is a load balancing relay and is not intended to clear a fault in the power system. In most applications it is used as an undervoltage device and is designed to de-energize the power circuit whenever voltage falls below a predetermined value. Time of operation may be instantaneous or delayed.

The time delay undervoltage relay is also an induction disk relay. The action of the spiral spring is to keep the relay contacts trip circuit closed. The torque produced when voltage is applied to the relay's voltage actuated coil opposes the spring action. Thus, as the applied voltage decreases, the disk rotates to close the relay trip circuit contacts.

The overvoltage relay has the opposite operation. The spring action keeps the relay trip circuit contacts open whenever voltage in the circuit is normal or below normal. A higher than normal voltage produces operating torque on the relay disk.

Prior to switching the test set on, there are no preliminary set-up of controls. Upon the initial powering up of the test set, all controls automatically reset to zero or off conditions.

ALWAYS REFER TO THE MANUFACTURERS LITERATURE BEFORE TESTING

TYPES OF TESTS

Pick-Up

Timing (This test requires the use of an EPOCH-III and one EPOCH-I)

PICK-UP TEST

1. Connect the EPOCH-III test set to a suitable source of power as indicated on the programmable AC input cord socket. Check to insure the POWER ON/OFF switch is OFF.
2. Connect a light set of leads from the red STOP/MONITOR binding posts to the trip circuit contact terminals of the relay induction unit.
3. Connect the relay operating coil to the red and white potential output binding posts of the Model EPOCH-III.
4. Switch POWER ON/OFF switch ON. Switch the MONITOR HORN and CONTINUITY switch ON.

5. Press the voltage OUTPUT ON/OFF switch to turn the voltage channel ON.
6. Increase the voltage output until the CONTINUITY light begins to flicker or the tone signal begins to break.
7. De-energize the voltage channel by pressing the OUTPUT ON/OFF Switch OFF.
8. Read and record pick-up voltage of relay from the VOLTS display.

TIMING TEST

This test requires the use of one Model EPOCH-III and one Model EPOCH-I.

NOTE: Refer to page 12 on selection of EPOCH-III Master unit and page 13 for explanation of the dynamic voltage relay test.

1. With the EPOCH-III and EPOCH-I test sets correctly interconnected, switch the POWER ON/OFF switches ON. Press the EPOCH-III ON LINE Switch.
2. Connect a set of light leads from the relay potential coils between the two red voltage output binding posts of the EPOCH-III and EPOCH-I test sets.
3. Set the EPOCH-III to supply the "normal" test voltage and switch the OUTPUT ON/OFF switch ON and the OUTPUT INITIATE Switch to the INITIATE position.
4. On the EPOCH-I, press the voltage channel INITIATE switch to the INITIATE position.
5. Set the desired "normal" voltage on the EPOCH-III test set. The relay under test should assume a normal operating condition.

For an undervoltage relay, follow steps 6 through 12. For an overvoltage relay, go to step 13.

6. Determine what test voltage is to be applied to the relay and set the difference between the "normal" voltage and the "fault" voltage on the EPOCH-I potential output display.

For example:

$$\begin{array}{rclcl}
 120 \text{ volts} & & & & \\
 \text{"normal"} & - & 72 \text{ volts} & = & 48 \text{ volts} \\
 & & \text{"fault"} & & \text{set on EPOCH-I}
 \end{array}$$

When the test system is initiated, the 48 volts from the EPOCH-I will subtract from the "normal" voltage on the EPOCH-III, thus the relay will "see" a fault voltage of 72 volts and will start to operate.

7. Press the TIMER START pushbutton to INTERNAL VOLTAGE start position.

8. Connect the red STOP circuit binding posts of the EPOCH-III to the relay trip circuit terminals.

NOTE: The outputs will either add or subtract depending on the phase angle. For subtraction, leave the EPOCH-I phase angles at zero. For additive voltages, set the EPOCH-I potential to a phase angle of 180°.

9. Press the RESET pushbutton and initiate the test set by pressing the MASTER INITIATE control switch. The voltages will either add or subtract causing the relay to start to operate. Additionally, the EPOCH-III timer will start.
10. When the relay trips, the timer will stop. Read and record time.
11. To repeat test, simply press the RESET pushbutton and then the MASTER INITIATE Control Switch.
12. After completion of tests, turn both test sets OFF.
13. For testing overvoltage relays, first determine what test voltage is to be applied to the relay and set the difference between the "fault" voltage and the "normal" voltage on the EPOCH-I voltage amplitude display. For example:

$$\begin{array}{rclcl} 180 \text{ volts} & - & 120 \text{Volts} & = & 60 \text{ Volts} \\ \text{"fault"} & & \text{"normal"} & & \text{set on EPOCH-I} \end{array}$$

Also, set 180° on the PHASE ANGLE along with the difference between the two voltages. When the test system is initiated, the 60 volts will add to the 120 volts already applied, and the relay will "see" an overvoltage of 180 volts and start to operate. After setting in the 180 degree phase angle and desired overvoltage, complete steps 7 through 12.

SERVICE DATA

Self Test

The EPOCH-III has two separate and independent oscillators, one for timing functions and one for frequency. Therefore, it has the ability to self check to insure that oscillators are stable and accurate. To perform the test follow the instructions below. For best results the unit should be tested while at room temperature 20°C to 30°C. If the unit has been stored at temperatures of 0°C or less, let the unit run at room temperature for several minutes. This will allow the fan to pull the warmer room air into the unit and stabilize the oscillators.

1. EPOCH-III power ON.
2. Switch the Timer Start Gate to Internal Frequency Start. Leave the Timer Stop Gate at N.O. Dry contacts position.
3. Switch the Timer Select button to the Seconds position, if not already there.
4. Set Normal Frequency to 60.000 HZ.
5. Press the Function Select Switch and set the Fault Frequency to 58.000 HZ.
6. Press the Function Select Switch. Set the Timer Start Frequency to 59.000 HZ.
7. Press the Function Select Switch. Leave the Duration Time at 0 seconds.
8. Press the Function Select Switch. Set F_1 equal to 2 HZ/Sec.
9. Press the Function Select Switch. Set F_2 equal to 2 HZ/Sec.
10. Press the Reset Switch.
11. Press the MASTER INITIATE Switch. The Frequency Output should start to delta down, to 58.000 Hz and then delta back up. The timer should be running until the Frequency delta's back up past 59.000HZ. At that point the timer should stop, indicating a time of 1.000 seconds.
12. Repeat steps 4 through 11 except at step 7 set Duration Time to 1 second. The timer should stop, indicating a time of 2.000 seconds.
13. Set Timer Stop Gate to stop on INTERNAL SYNC.
14. Press Timer Latch Switch to Start ON position.
15. Press the RESET Switch. Press the MASTER INITIATE Switch. When the timer stops it should

read 0.5000 seconds.

**Insert
SCHEMATIC**