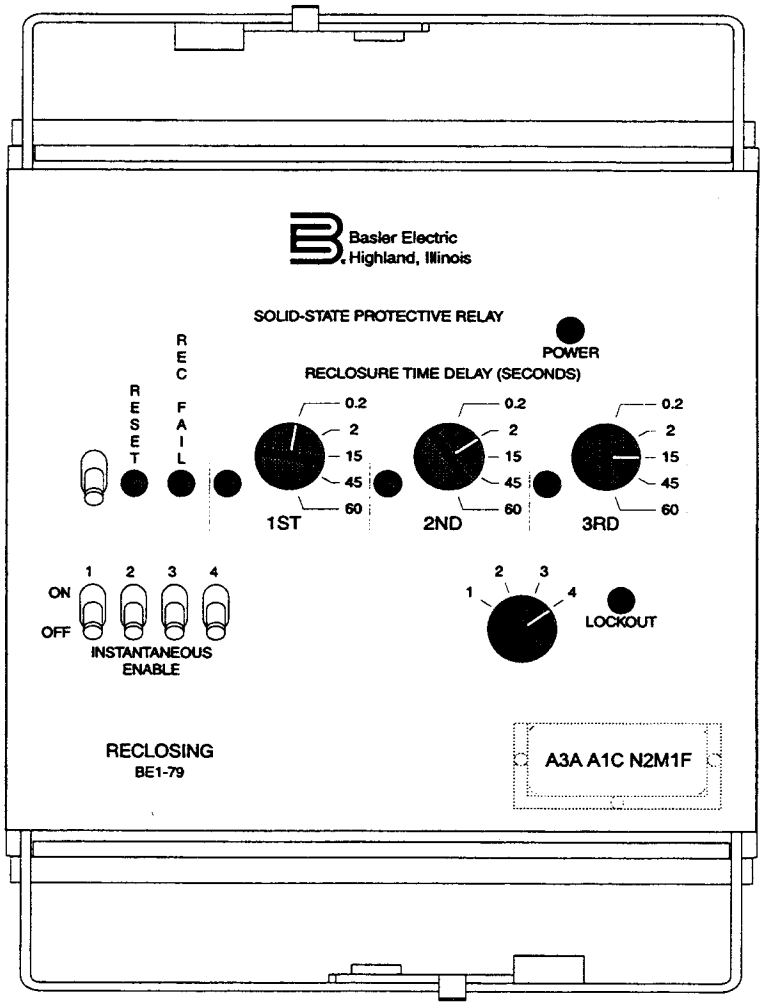
INSTRUCTION MANUAL
FOR
MULTIPLE SHOT RECLOSING RELAY
MODEL NUMBER BE1-79



Basler Electric
Highland, Illinois

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I N T R O D U C T I O N

The purpose of this Instruction Manual is to furnish information concerning the operation and installation of this device. To accomplish this, the following is provided.

1. **Specifications**
2. **Functional description**
3. **Operational tests**
4. **Mounting information**

A Service Manual, publication 9 1368 00 620 is available as an aid in troubleshooting and repair.

WARNING

TO AVOID PERSONAL INJURY OR EQUIPMENT DAMAGE, ONLY QUALIFIED PERSONNEL SHOULD PERFORM THE PROCEDURES PRESENTED IN THIS MANUAL.

THIS MANUAL MAY BE USED IN PLACE OF ALL EARLIER EDITIONS.

FOR INFORMATION CONCERNING EARLIER EDITIONS, SEE SECTION 7.

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It is not the intention of this manual to cover all details and variations in equipment, nor does this manual provide data for every possible contingency regarding installation or operation. The availability and design of all features and options are subject to modification without notice. Should further information be required, call Basler Electric Company, Highland, Illinois.

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SECTION 1

GENERAL INFORMATION

PURPOSE

The BE1-79 Multiple Shot Reclosing Relay is a solid-state device that provides automatic reclosure of circuit breakers that have been tripped by a protective relay. Because many power circuit faults are temporary, the reclosing relay can be programmed to make up to three attempts to re-establish service.

DESCRIPTION

The Basler Multiple Shot Reclosing Relay senses opening and closing of an associated circuit breaker. When the breaker opens, a form B auxiliary contact on the controlled circuit breaker closes. The relay senses this contact closure and, after a programmed interval to allow any arcing to dissipate, recloses the breaker. If the fault still exists after the breaker has been reclosed, the relay will make two more attempts at independently programmable intervals. If the fault is still not cleared, and the breaker trips a fourth time, no further attempts will be made to automatically reclose the breaker.

Programming of the individual reclosing intervals is available with either definite time delay steps or continuously adjustable intervals. With the definite time option, the reclosing delay intervals are individually selected on three front panel switches. Each switch has five positions and covers a range from 0.2 to 60 seconds. With the continuous time option, the reclosing delay intervals are individually set with three front panel controls and associated range toggle switches. Each control (together with its range switch) provides a continuous adjustment from 0.2 to 60 seconds.

A disable function is provided in the reclosing relay to inhibit automatic reclosing. When an external contact connected to the relay's disable input is closed, the relay ignores any breaker tripping action and no automatic reclosing is attempted.

Options are available:

(1) To provide either isolated or non-isolated contact sensing;
(2) To limit the number of reclosure attempts;
(3) To enable instantaneous breaker tripping for any trip;
(4) To initiate a remote alarm when a reclosure attempt is unsuccessful (the breaker does not close within a set time limit); and
(5) To reset the relay when a reclosure is not followed by a trip after a programmed interval.

The relay assembly is mounted in a drawout cradle and enclosed in a standard, utility style case available with either semi-flush or projection mounting. Circuit components are accessible by removal of the individual printed circuit boards from the relay cradle, and by using an extender board (Basler part number 9 1129 30 101) to test or troubleshoot.

MODEL AND STYLE NUMBER

The electrical characteristics and optional features included in a particular style BE1-79 relay are defined by a combination of letters and numbers that make up its style number. The model number, followed by the style number, appears on the front panel, drawout cradle, and inside the case assembly. The sample style number below, as well as in Figure 1-1, illustrates the use of the Style Number Identification Chart (on page 1-3) in identifying the particular features of an individual relay. Upon receipt of a reclosing relay, be sure to check the style number against the requisition and packing list to see that they agree.

SAMPLE STYLE NUMBER A1A A5C A2M1F

The style number above describes a BE1-79 Multiple Shot Reclosing Relay having the following features:

(A) Multiple shot reclosing
(1) Lockout and automatic reset
(A) Instantaneous trip enable output can be selectably controlled for each of 4 (maximum) pre-trip periods
(A5) Continuously adjustable reclosure time delay
(C) Operating power obtained from nominal 125 Vdc or 100/120 Vac external source
(A) Reset time delay adjustable from 10 to 60 seconds
(2) Maximum reclosing signal of 2 to 3 seconds duration
(M) Isolated contact sensing input(s)
(1) Reclose failure alarm contact
(F) Semi-flush mounting

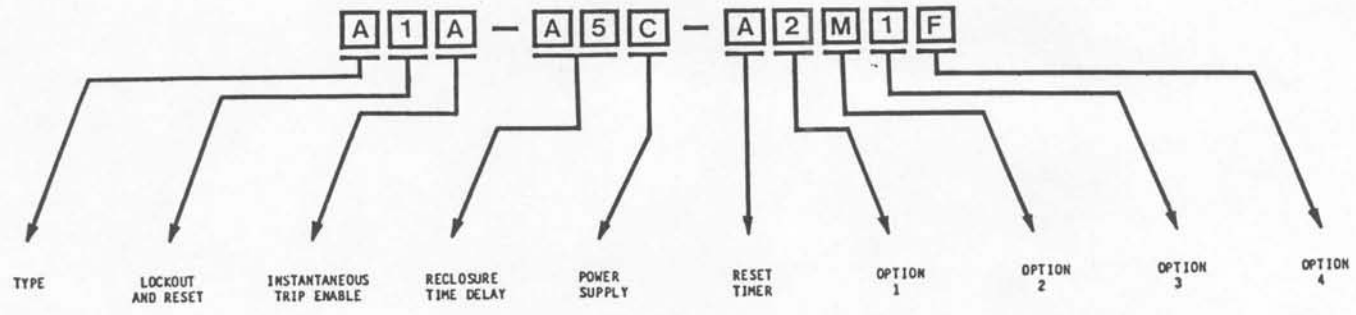
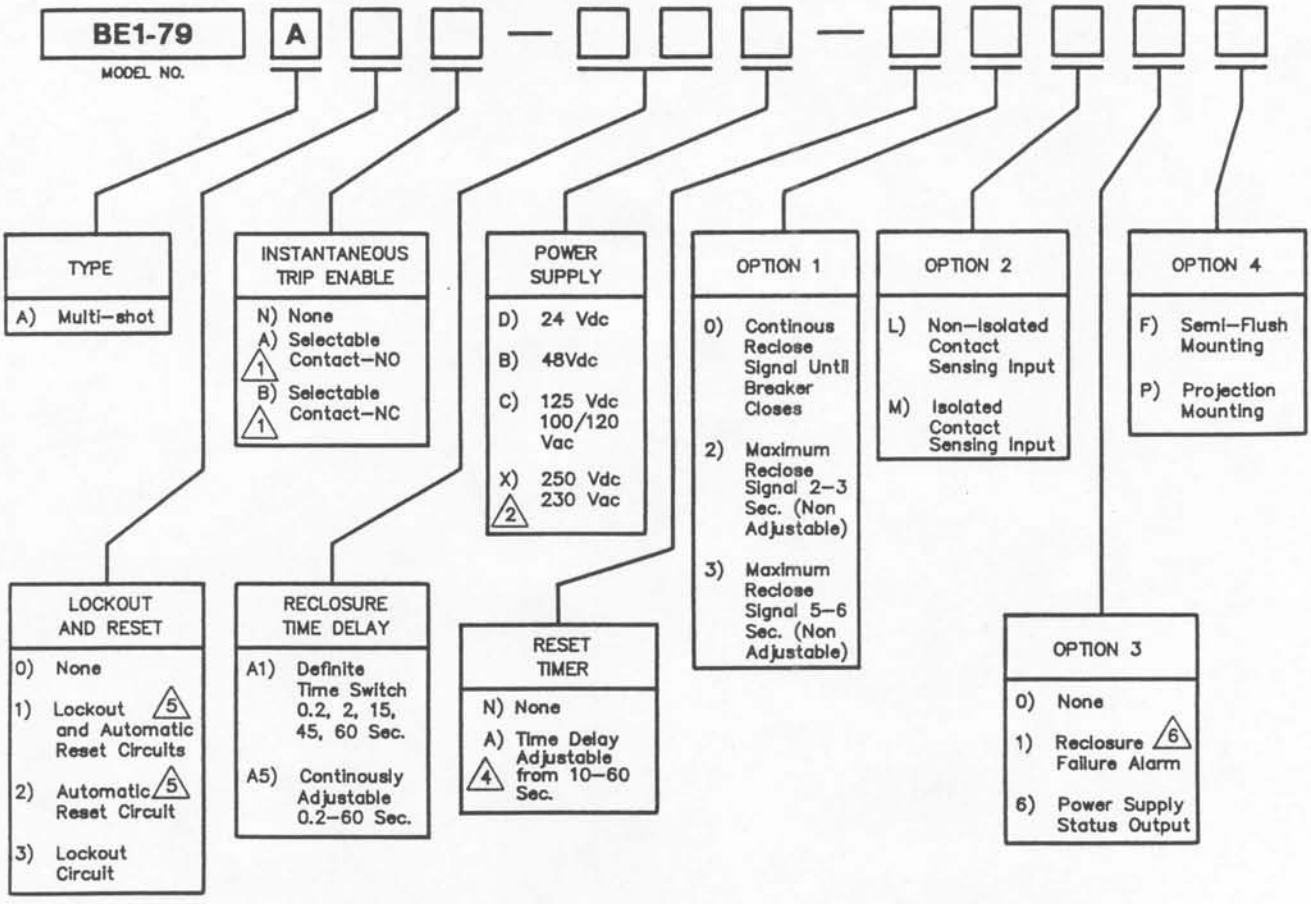


Figure 1-1. Style Number Block Diagram

STYLE NUMBER IDENTIFICATION CHART



NOTES:

1. The internal logic of the relay provides that, when the relay is powered up, there is no difference between Option A and Option B function. But with power OFF, the Option A contact is always open, and the Option B contact is always closed. See table below.

INSTANTANEOUS TRIP ENABLE (ITE) CONDITIONS	WITH POWER TO RELAY		NO POWER TO RELAY	
	OPTION A CONTACT	OPTION B CONTACT	OPTION A CONTACT	OPTION B CONTACT
BREAKER CLOSED AND RELEVANT ITE SWITCH CLOSED.	CLOSED	CLOSED	OPEN	CLOSED
ALL OTHER CONDITIONS	OPEN	OPEN	OPEN	CLOSED

2. When the power supply is X, an external contact sensing module is required:

OPTION 2	CONTACT SENSING MODULE
L	9 1463 01 105
M	9 1463 01 104

3. All relays are supplied in an S1-size case.

4. If reset timer is A, lockout and reset must be 1 or 2.

5. If lockout and reset are 1 or 2, reset timer must be A.

6. If Option 3 is 1, Option 1 must be 2 or 3.

SPECIFICATIONS

Power Input

In order to satisfy a variety of external voltage sources that may be available, one of the four types of power supplies listed in Table 1-1 may be optionally selected to provide internal relay operating power.

TABLE 1-1. POWER SUPPLY OPTIONS

Type	Nominal Input Voltage	Input Voltage Range	Burden at Nominal Voltage (Relay tripped)
B	48 Vdc	24 to 60 Vdc	4.9 W
C	125 Vdc 120 Vac	62 to 150 Vdc 90 to 132 Vac	6.7 W 11.3 VA $
D*	24 Vdc	12 to 32 Vdc	3.8 W
X†	250 Vdc 230 Vac	140 to 280 Vdc 190 to 270 Vac	5.8 W 11.6 VA $

* Type D power supply may initially require 14 Vdc to begin operating. Once operating, the voltage may be reduced to 12 Vdc and operation will continue.

† Relays with Type X supply require an external sensing module.

$ At 50 or 60 Hz.

Contact Sensing
(Applies to the breaker sensing input and the disable contact input.)

The contact sensing circuits require user-supplied contacts with a minimum rating of 0.05 A at 250 Vdc. Sensing current is supplied by the relay in styles with isolated sensing. Styles with non-isolated sensing require an externally applied dc sensing voltage equal to the relay's dc power supply input rating. Burden per contact for non-isolated sensing, dependent on power supply type, is listed below.

Power Supply Type	B	C	D	X
Burden Per Input	3.5W	4.5W	2.0W	7.5W

Outputs

Output contacts are rated as follows:

Resistive

120/240 Vac - make 30 A for 0.2 seconds, carry 7 A continuously, and break 7 A.

250 Vdc - make and carry 30 A for 0.2 seconds, carry 7 A continuously, break 0.1 A.

500 Vdc - make and carry 15 A for 0.2 seconds, carry 7 A continuously, break 0.1 A.

	Inductive 120/240 Vac, 125 Vdc, 250 Vdc - break 0.1 A (L/R = 0.04).
Reclosure Time Delay	Continuously adjustable or switch-selected according to the option chosen. In either case, the overall adjustment range is from 0.2 to 60 seconds.
Reclose Signal	The reclosing output contact may be specified to provide a continuous closing signal until reset by breaker closure, or for a maximum duration of 2 to 3 seconds, or for a maximum duration of 5 to 6 seconds, as defined by the style number designation.
Reset Time Delay Option	Provides switch-selected reset delays of 10, 15, 20, 40 and 60 seconds.
Timing Accuracy	Within 5% for both reset and reclosure time delays, over the specified range of operating temperatures and voltages.
Operating Temperature	-20°C (-4°F) to +65°C (+149°F).
Storage Temperature	-50°C (-58°F) to +90°C (+194°F).
Shock	In standard tests the relay has withstood 15g in each of three mutually perpendicular axes without structural damage or degradation of performance.
Vibration	In standard tests the relay has withstood 2g in each of three mutually perpendicular axes swept over the range of 10 to 500 Hz for a total of six sweeps, 15 minutes each sweep, without structural damage or degradation of performance.
Surge Withstand Capability	Qualified to ANSI/IEEE C37.90-1978 and C37.90a-1974 Surge Withstand Capability Test and IEC 255-5 Impulse Test.
Case size	S1.
Weight	11.75 pounds net.

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SECTION 2

CIRCUITS

GENERAL

The circuit descriptions that follow are referenced to the functional block diagram of Figure 2-1.

POWER SUPPLY

The solid-state power supply is a low burden, flyback switching design which delivers a nominal +12 Vdc to internal circuitry. The power supply inputs are not polarity sensitive. A red LED illuminates to indicate that the power supply is functioning properly.

If the Type X power supply is used, an external sensing input module is required and connections must be modified accordingly (Figure 4-6).

CONTACT SENSING

Depending on the style of the relay, contact sensing current is obtained either directly from the Multiple Shot Reclosing Relay (for isolated contact sensing), or from any external dc power source with a voltage rating equal to the power supply's nominal dc input voltage (for non-isolated contact sensing). (Ac is not used for contact sensing.) The function of each set of sensing contacts is described in Table 2-1.

TABLE 2-1. FUNCTION OF SENSING CONTACTS

Contact	Designation	Function
Disable Contact	DC	A form A contact on the controlled circuit breaker. When this contact is closed, the relay is inhibited from responding to subsequent breaker operations.
Breaker	52b	A form B auxiliary contact of the controlled breaker used to indicate whether the breaker is open or closed.

COUNTER

The counter is incremented each time the sensing circuit detects a change of state at the breaker. Initially, the counter has a count of zero and the breaker is closed. Table 2-2 relates the succeeding counts (corresponding to each change of state of the breaker) to the relay's response.

The counter is reset to zero when the relay is manually reset or, in relays supplied with the reset option, the counter is automatically reset to zero when the breaker remains closed for the entire reset delay. Counting is inhibited when the counter reaches a count of 7, when the disable contacts are closed, or when the LOCKOUT feature is enabled. If the relay is manually reset before the breaker is restored, the counter is reset but counting is inhibited until breaker closure occurs.

RECLOSE MEMORY

The reclose memory responds to the counter, lighting the 1ST, 2ND, and 3RD LED reclosure indicators respectively as the proper count is reached. The reclosure indicators remain lit until the relay is manually reset or operating power is interrupted.

RECLOSE TIME DELAY CIRCUIT

Counts 1, 3, and 5 from the counter cause the reclose time delay circuit to compare the selected delay interval with the elapsing time. When the two become equal, a signal is generated to activate the reclosing contacts.

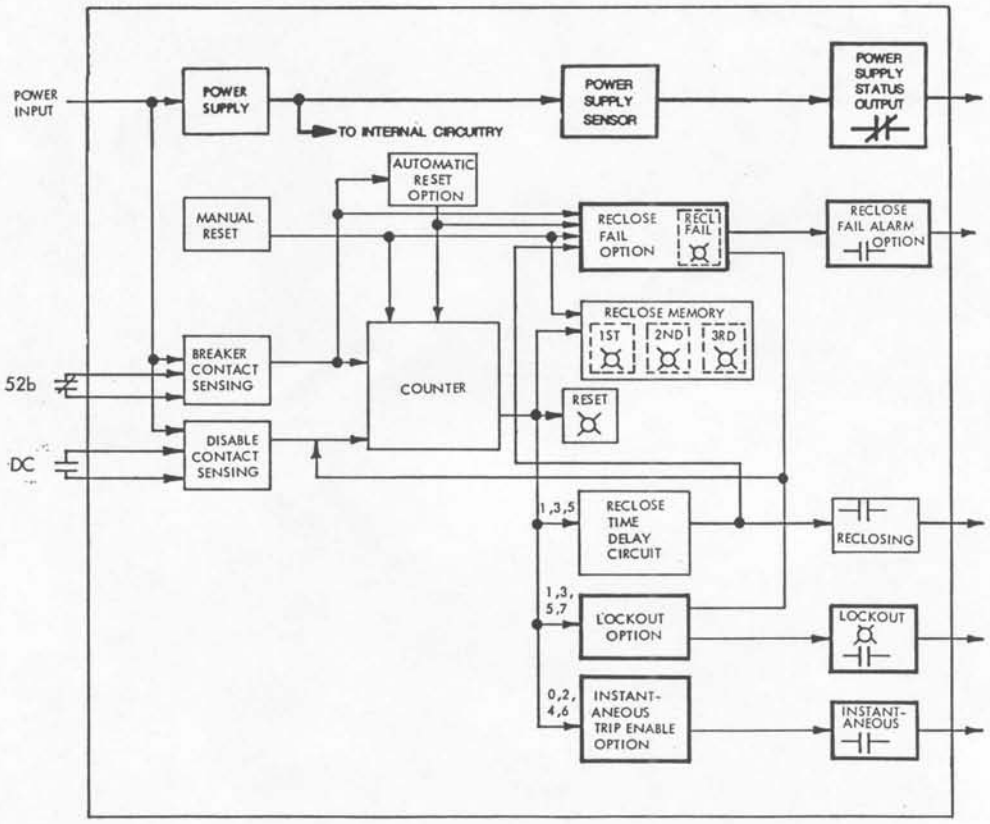

Figure 2-1. Functional Block Diagram

MANUAL RESET

Manual reset of the relay is by a momentary switch which may be actuated by a linkage accessible through the front cover of the case. Whenever the switch is actuated, it resets the counter to zero and clears the reclose memory, extinguishing any RECLOSURE or LOCKOUT LEDs that were on and lighting the RESET LED. (But counting is inhibited until breaker is reclosed.)

TABLE 2-2. BREAKER STATE AND COUNT SEQUENCE

Breaker Condition	Count	Result
Breaker closes and counter resets	0	RESET LED is illuminated.
Breaker opens	1	The first reclose time delay starts. A BREAKER CLOSE signal is generated at the end of this time delay.
First reclosure of breaker	2	The reclose memory turns on 1ST LED. Reset timer is started.
Breaker opens prior to expiration of reset delay	3	The second reclose time delay starts. The BREAKER CLOSE signal is generated at end of this time delay.
Second reclosure of breaker	4	Reclose memory illuminates 2ND LED. Reset timer is started.
Breaker opens prior to expiration of reset delay	5	Third reclose time delay starts. The Breaker close signal is generated at the end of this time delay.
Third reclosure of breaker	6	Reclose memory illuminates 3RD LED. Reset timer is started.
Breaker opens prior to expiration of reset delay	7	Counter is inhibited. Further relay action is inhibited until breaker is closed by other means and the relay is reset.

RESET OPTION

The reset option resets the counter to zero when the breaker remains closed for a preprogrammed interval established by a RESET TIME control. During this

interval, a reopening of the controlled breaker will terminate the reset timing cycle. For any subsequent breaker closure the reset timer must then begin its timing cycle anew.

When the controlled breaker is manually closed following a lockout condition, or following a successful automatic reclosure, the reset timer option will be initiated. The timer will then reset the counter to zero at completion of its timing cycle.

RECLOSE FAIL OPTION

The reclose fail option monitors the output of the breaker auxiliary contact (52b) sensing circuit and the reclose time delay circuit. When the reclose time delay circuit actuates the reclosing contacts, the reclose fail option looks for an indication that the breaker is closed. If this indication is not received within a specified interval (possibly due to breaker failure), the reclose fail circuits inhibit further operation of the counter, locking out the reclosing relay and interrupting current to the breaker closing coil. A REC FAIL indicator on the relay is illuminated and an optional alarm relay is energized when a reclose failure occurs. The reclose failure option may be reset by manually resetting the relay or, in relays equipped with the automatic reset option, by the breaker remaining closed for the programmed reset time interval after the breaker is normally closed.

LOCKOUT OPTION

The lockout option provides the capability of preprogramming the relay for zero, one, two, or three reclosures. A four position LOCKOUT selector switch is provided on the relay front panel for this programming. When a reclosing sequence has reached the limit imposed by the lockout setting, the counter and the reclose time delay circuits are inhibited until the relay is reset. When the relay is locked-out, the LOCKOUT indicator is illuminated, and the lockout alarm contact is closed.

Note that when the LOCKOUT switch is set to 1, the relay is locked out when the counter counts the first trip, effectively eliminating automatic reclosing. Setting the LOCKOUT switch to 2, 3, or 4 trips permits one, two, or three reclosures respectively.

INSTANTANEOUS TRIP ENABLE OPTION

The Instantaneous Trip Enable Option includes the following items.

(a) An additional output relay. Note that the style chart shows two versions of this option: A and B. The truth table for the two versions is shown in Table 2-3.

(b) Four toggle switches located on the front panel and labeled INSTANTANEOUS ENABLE 1, 2, 3, and 4. Each switch number represents, in order of progression, one of the four breaker trips that may occur in a reclosing sequence.

(c) Logic circuitry which causes the aforementioned contact to be closed for the time period which precedes any of four breaker trips IF the corresponding switch is UP.

Application of this option is illustrated in Figure 4-5, which shows how the instantaneous trip enable contact (K4) may be used to enable selected devices in the scheme which controls the breaker.

POWER SUPPLY STATUS OUTPUT (Option 3-6)

The power supply status output relay is energized upon power-up, thus opening its contact. Normal relay operating voltage maintains the power supply status output relay continually energized and its output contact open. However, if the power supply output voltage falls below the requirements of proper operation, the power supply output relay de-energizes, thus closing the NC output contact.

TABLE 2-3.

TRUTH TABLE FOR THE INSTANTANEOUS TRIP ENABLE OPTION

INSTANTANEOUS TRIP ENABLE (ITE) CONDITIONS	WITH POWER TO RELAY		NO POWER TO RELAY	
	OPTION A CONTACT	OPTION B CONTACT	OPTION A CONTACT	OPTION B CONTACT
BREAKER CLOSED AND RELEVANT ITE SWITCH CLOSED.	CLOSED	CLOSED	OPEN	CLOSED
ALL OTHER CONDITIONS	OPEN	OPEN	OPEN	CLOSED

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SECTION 3

CONTROLS AND INDICATORS

POWER Indicator	A red light emitting diode illuminates when the relay power supply is supplying a nominal ±12 Vdc to the relay internal circuitry.
RESET Switch	A momentary switch which resets the circuitry of the relay. The switch may be actuated by a lever which extends through the cover. Resetting the relay resets the counter, the reclose fail, and the lockout options; also, it turns ON the RESET indicator, and turns OFF the REC FAIL, LOCKOUT, and RECLOSURE indicators.
RESET Indicator	This green light emitting diode illuminates when the relay is reset.
REC FAIL Indicator (reclose fail option only)	This red light emitting diode illuminates when a failure to reclose has occurred.
RECLOSURE TIME DELAY Indicators (1ST, 2ND, 3RD)	These red light emitting diodes illuminates when the corresponding reclosure attempt has occurred. They extinguish when the relay is manually reset, or when power is interrupted. These indicators provide a visual record of the maximum number of reclosure attempts that have occurred during any (reclose) sequence taking place since the last manual reset of the relay.
RECLOSURE TIME DELAY Switches (1st, 2nd, and 3rd) (on relays with Definite Time - Option A1)	Each of these five-position selector switches allows reclosure delays of 0.2 (±10%) or 2, 15, 45, and 60 (±5%) seconds. A selector switch is provided for each reclosure.
RECLOSURE TIME DELAY Controls (1st, 2nd, and 3rd) (on relays with Continuously Adjustable Time - Option A5)	A three position toggle switch allows reclosure delay range selection of 0.2-2.0, 1.5-15, or 6.0-60 seconds. A continuously adjustable dial sets the precise delay within the selected range.

INSTANTANEOUS 1, 2, 3, and 4 Switches (Instantaneous Trip Enable Option)	In the up position, these switches provide closure of the instantaneous trip enable output (ITEO) contact prior to the corresponding breaker trip. For example, switch 1 (when UP) closes the ITEO contact when the relay is reset. Similarly, switches 2, 3, and 4 close the contact prior to the second, third, and fourth (last) trip respectively. (The ITEO contact is typically used in conjunction with an instantaneous overcurrent protection relay as shown in Figure 4-5.)
LOCKOUT Switch (Lockout Option)	A four-position switch that establishes the maximum number of trips permitted prior to lockout. When set to position 1, the reclosing relay is disabled. When set to positions 2, 3, or 4, maximum of one, two, or three reclosures are permitted respectively. (The last permissible trip causes lockout rather than reclosure.)
LOCKOUT indicator (Lockout Option)	A red light emitting diode illuminates when the relay is inhibited from further operation by the lockout option.
RESET TIME (SEC) Switch (Reset Time Option)	A five-position switch with positions labeled 10, 15, 20, 40, and 60. Setting the switch determines the number of seconds the breaker must remain closed before the relay will automatically reset. If the relay is locked out by the lockout option, or if a reclose failure has occured, manual reclosing of the breaker will reset the relay after the breaker has remained closed for the indicated interval. Note that when the reset timer option resets the relay, the RECLOSURE TIME DELAY indicators are not extinguished. These indicators remain illuminated until the relay is manually reset.

SECTION 4

INSTALLATION

GENERAL

When not shipped as part of a control or switchgear panel, the relays are shipped in sturdy cartons to prevent damage during transit. Immediately upon receipt of a relay, check the model and style number against the requisition and packing list to see that they agree. Visually inspect the relay for damage that may have occurred during shipment. If there is evident damage, immediately file a claim with the carrier and notify the Regional Sales Office, or contact the Sales Representative at Basler Electric, Highland, Illinois.

In the event the relay is not to be installed immediately, store the relay in its original shipping carton in a moisture and dust free environment. When the relay is to be placed in service, it is recommended that the following operational test be performed prior to installation.

RELAY OPERATING PRECAUTIONS

Before installation or operation of the relay, note the following precautions:

1. The relay is a solid-state device. If a wiring insulation test is required, remove the connecting plugs and withdraw the cradle from its case.

2. When the connecting plugs are removed the relay is disconnected from the operating circuit and will not provide system protection. Always be sure that external operating (monitored) conditions are stable before removing a relay for inspection, test, or service. Also, be sure that connecting plugs are in place before replacing the front cover.

3. Be sure the relay case is hard wired to earth ground using the ground terminal on the rear of the unit. Use a separate ground lead to the ground bus for each relay.

DIELECTRIC TEST

In accordance with IEC 255-5 and ANSI/IEEE C37.90-1978, one-minute dielectric (high potential) tests may be performed up to 2500 Vac (45-65 Hz) except across open contacts, which may be tested up to 1500 Vac. Note that this device employs decoupling capacitors to ground from terminals 3, and 4. Accordingly, a leakage current is to be expected at these terminals.

MOUNTING

Relay outline dimensions and panel drilling diagrams are supplied on pages 4-4 and 4-5.

CONNECTIONS

Typical external connections are shown on pages 4-6 and 4-7.

Incorrect wiring may result in damage to the relay. Be sure to check model and style number against the options listed in the Style Number Identification Chart before connecting and energizing a particular relay. Connections should be made with 14 AWG stranded wire or better.

NOTE: Be sure the relay case is hard-wired to earth ground with no smaller than 12 AWG copper wire attached to the ground terminal on the rear of the relay case. When the relay is configured in a system with other protective devices, always use a separate lead to the ground bus from each relay.

Terminals 3 and 4 are external relay power supply voltage inputs and are not polarity sensitive.

Relays containing the Type X (250 Vdc, 230 Vac) power supply require and external sensing input module. Connections for this module are shown in Figure 4-6.

Removal of the connecting plug(s) opens the reclosing contact, power, and instantaneous enable circuits before opening the contact sensing circuits.

STORING

In the event that the relay is not to be installed immediately, or has been taken out of service, store the relay in its original shipping carton in a moisture and dust free area.

NOTE: This protective relay contains Aluminum Electrolytic Capacitors which generally have life expectancy in excess of 10 years at storage temperatures less than 40°C. Typically, the life expectancy of the capacitor is cut in half for every 10°C rise in temperature. Storage life can be extended, if at 1 year intervals, power is applied to the relay for a period of thirty minutes.

TABLE 4-1. TERMINAL DESIGNATIONS†

Terminal	Designation
1	Normally open reclose contact
2	Normally open lockout contact
3*	Power
4*	Power
5	Normally open lockout contact
6*	Disable contact sensing
7*	Disable contact sensing
8*	52b contact sensing
9*	52b contact sensing
10	Normally open reclose contact
11	Normally open instantaneous contact
12	Normally open reclose fail contact
13	Normally open reclose fail contact or normally closed power supply status contact
14	Normally closed power supply status contact
20	Instantaneous trip enable contact

(*) Power and sensing input configurations will vary for relays having Type X (250 Vdc, 230 Vac) power supply. See Figure 4-6.

(†) Terminal use depends on selected options.

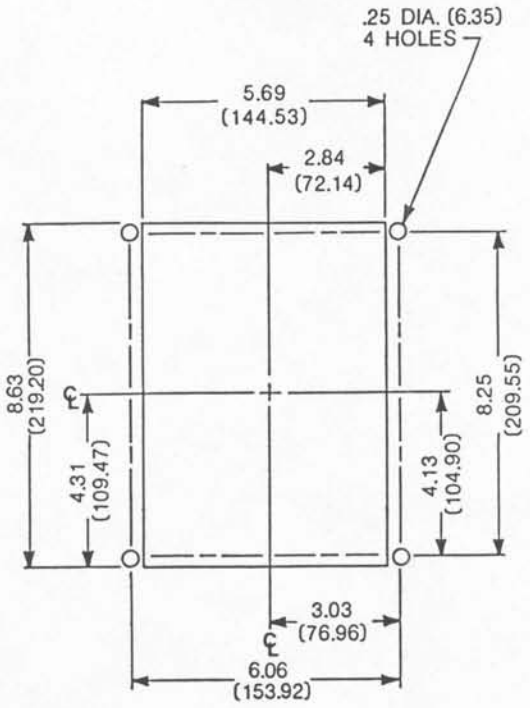


Figure 4-1. Panel Drilling Diagram (Flush Mounting)

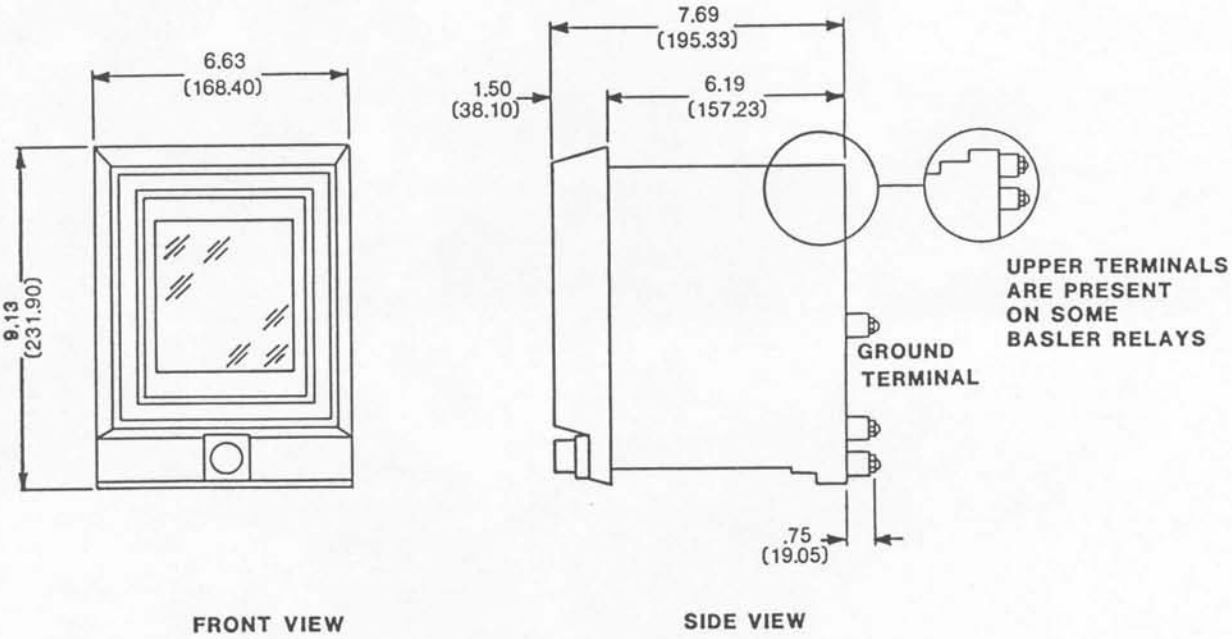


Figure 4-2. Outline Dimensions (Flush Mounting)

NUMBERS IN PARENTHESES INDICATE METRIC DIMENSIONS (MILLIMETERS). ALL OTHER DIMENSIONS ARE IN INCHES.

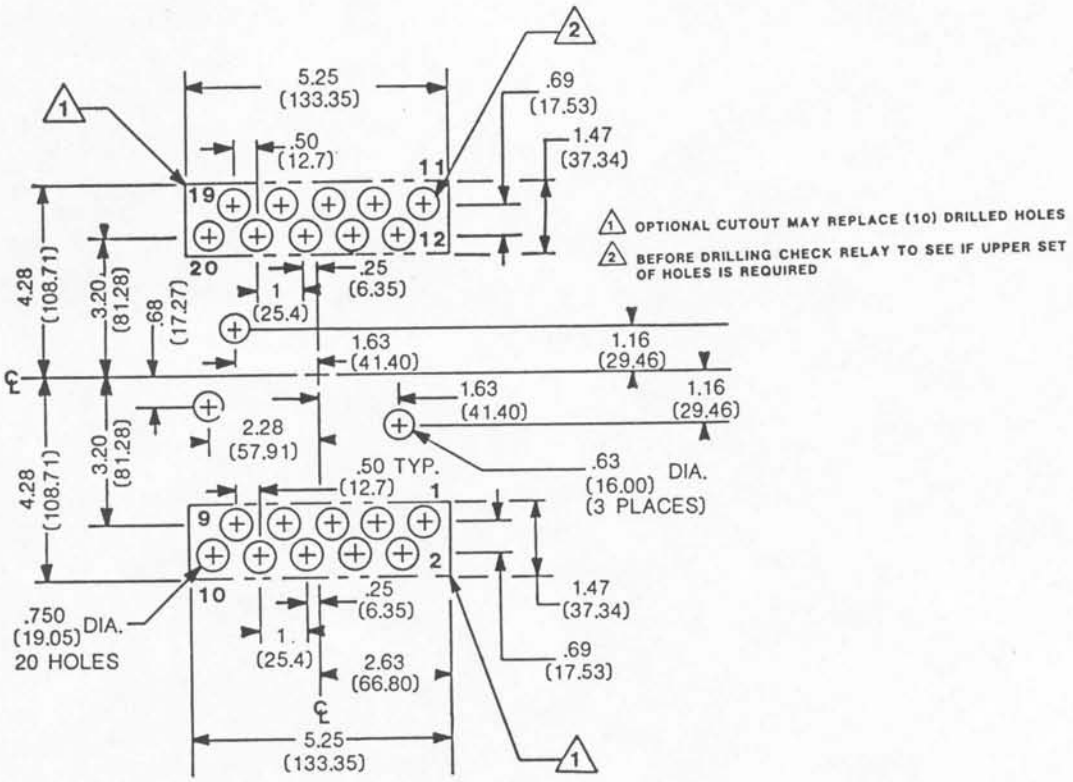


Figure 4-3. Panel Drilling Diagram (Projection Mounting)

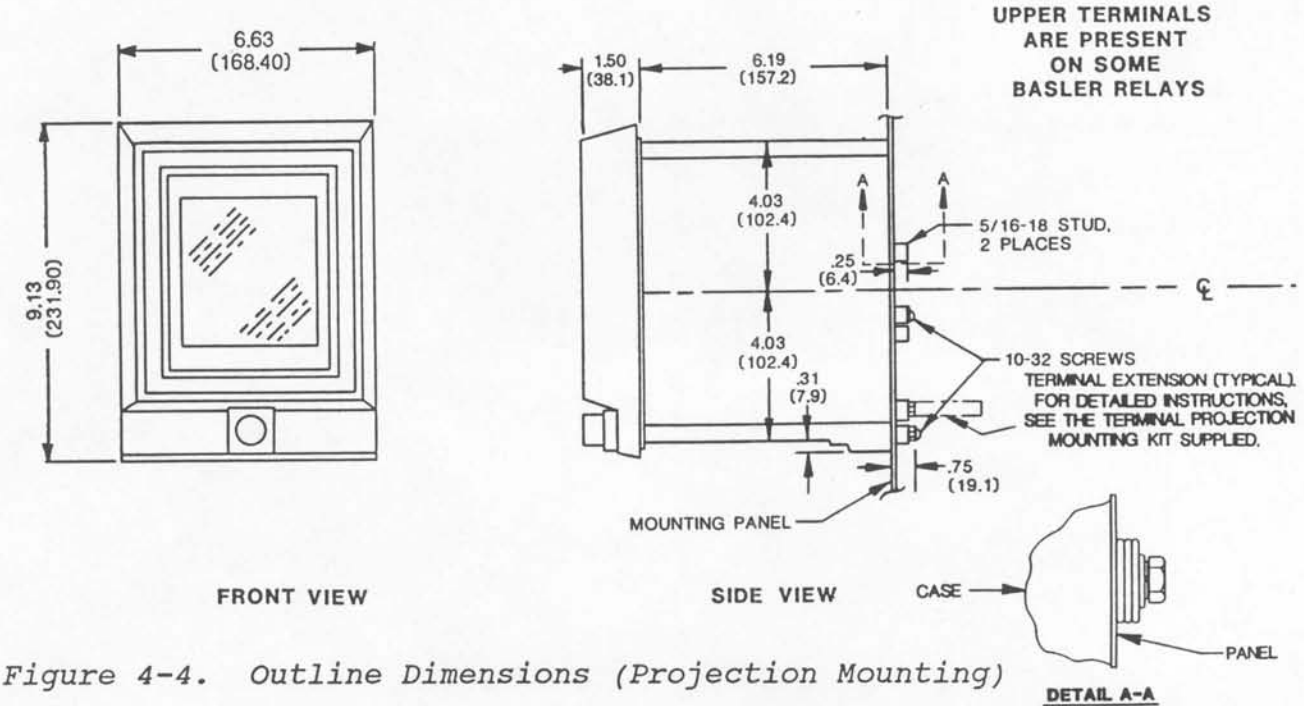
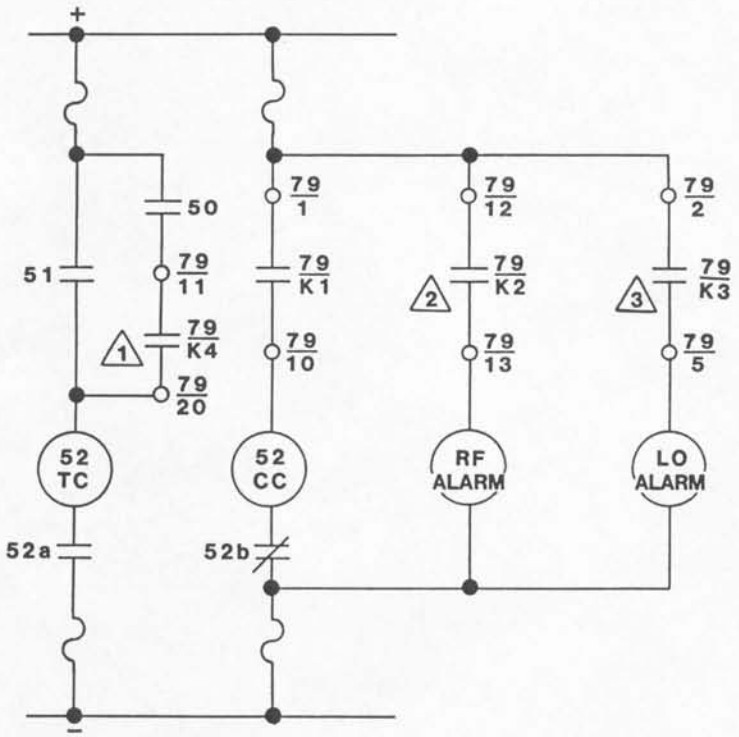


Figure 4-4. Outline Dimensions (Projection Mounting)

NUMBERS IN PARENTHESES INDICATE METRIC DIMENSIONS. ALL OTHER DIMENSIONS ARE IN INCHES.



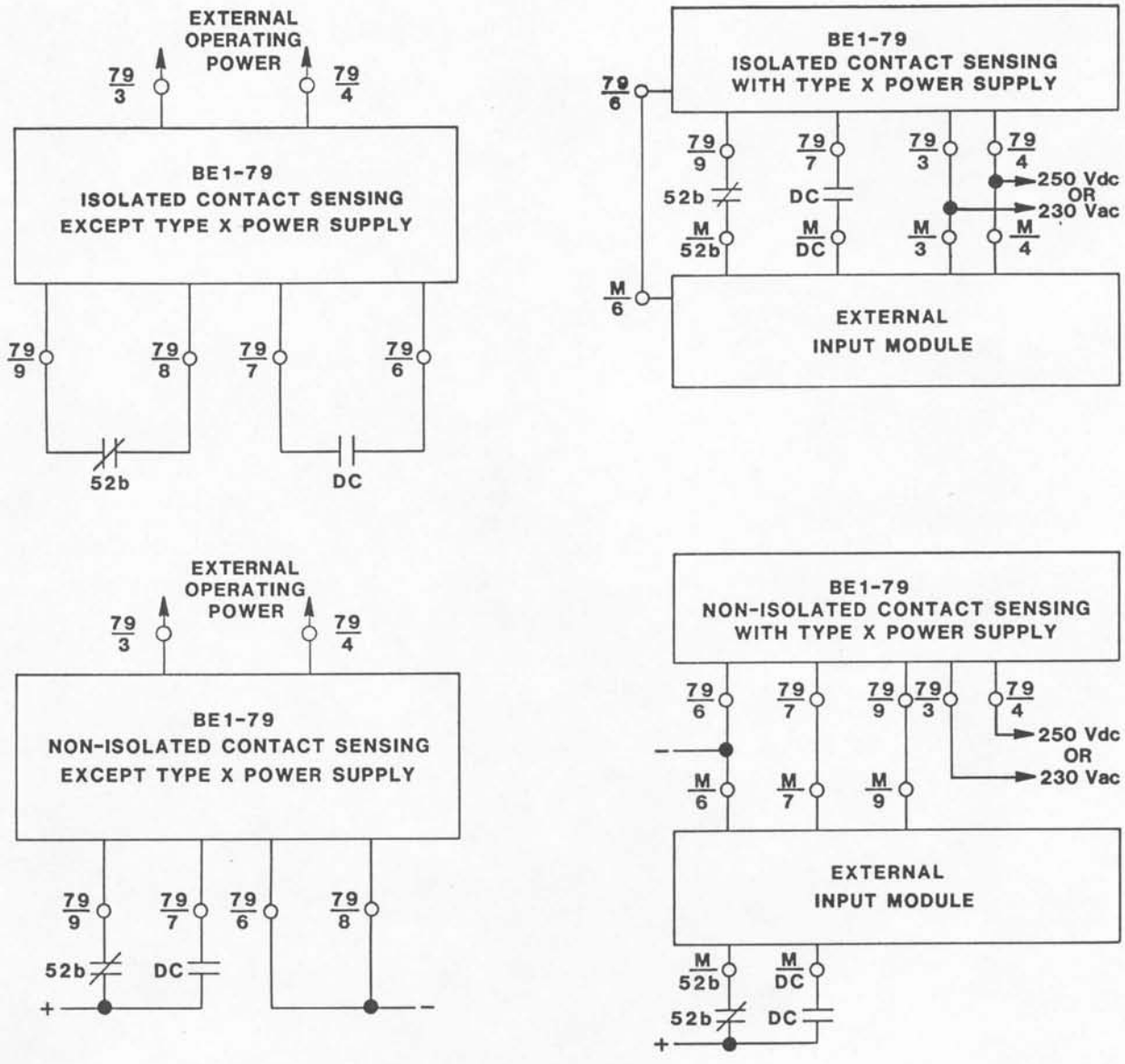
NOTES:

1. K4 CONTACTS PROVIDED WITH INSTANTANEOUS TRIP ENABLE OPTION.
2. K2 CONTACTS PROVIDED WITH RECLOSE FAILURE ALARM OPTION (NO), OR WITH POWER SUPPLY STATUS OPTION (NC).
3. K3 CONTACTS PROVIDED WITH LOCKOUT OPTION.

LEGEND:

50 INSTANTANEOUS OVERCURRENT RELAY	CC BREAKER CLOSING COIL
51 TIME OVERCURRENT RELAY	TC BREAKER TRIP COIL
52 POWER CIRCUIT BREAKER	DC DISABLE CONTACTS
79 RECLOSING RELAY	∿ FUSE
52a BREAKER AUXILIARY CONTACTS	RF RECLOSE FAILURE
52b BREAKER AUXILIARY CONTACTS	LO LOCKOUT

Figure 4-5. Output Circuit Connections (Typical)



LEGEND:

52b BREAKER AUXILIARY CONTACTS
DC DISABLE CONTACTS
79 RECLOSING RELAY
M SENSING INPUT MODULE

Figure 4-6. Input Circuit Connections (Typical)

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SECTION 5

TESTING AND CALIBRATION

GENERAL

The following procedures permit bench testing of the relay prior to installation, or while installed in a system, by use of standard test plug(s), Basler part number 10095 or G.E. Model XLA12A. Note that the procedure for testing or calibrating relays with definite time delays is given first, followed by the procedure for continuous time relays.

DEFINITE TIME DELAY TEST AND CALIBRATION

Step 1. Connect the relay as shown in Figure 5-1. With the unit in a powered-up condition, verify that the power supply status output contact is energized open (terminals 12 and 13 if equipped with this option). Remove input power and verify that the status output contact closes.

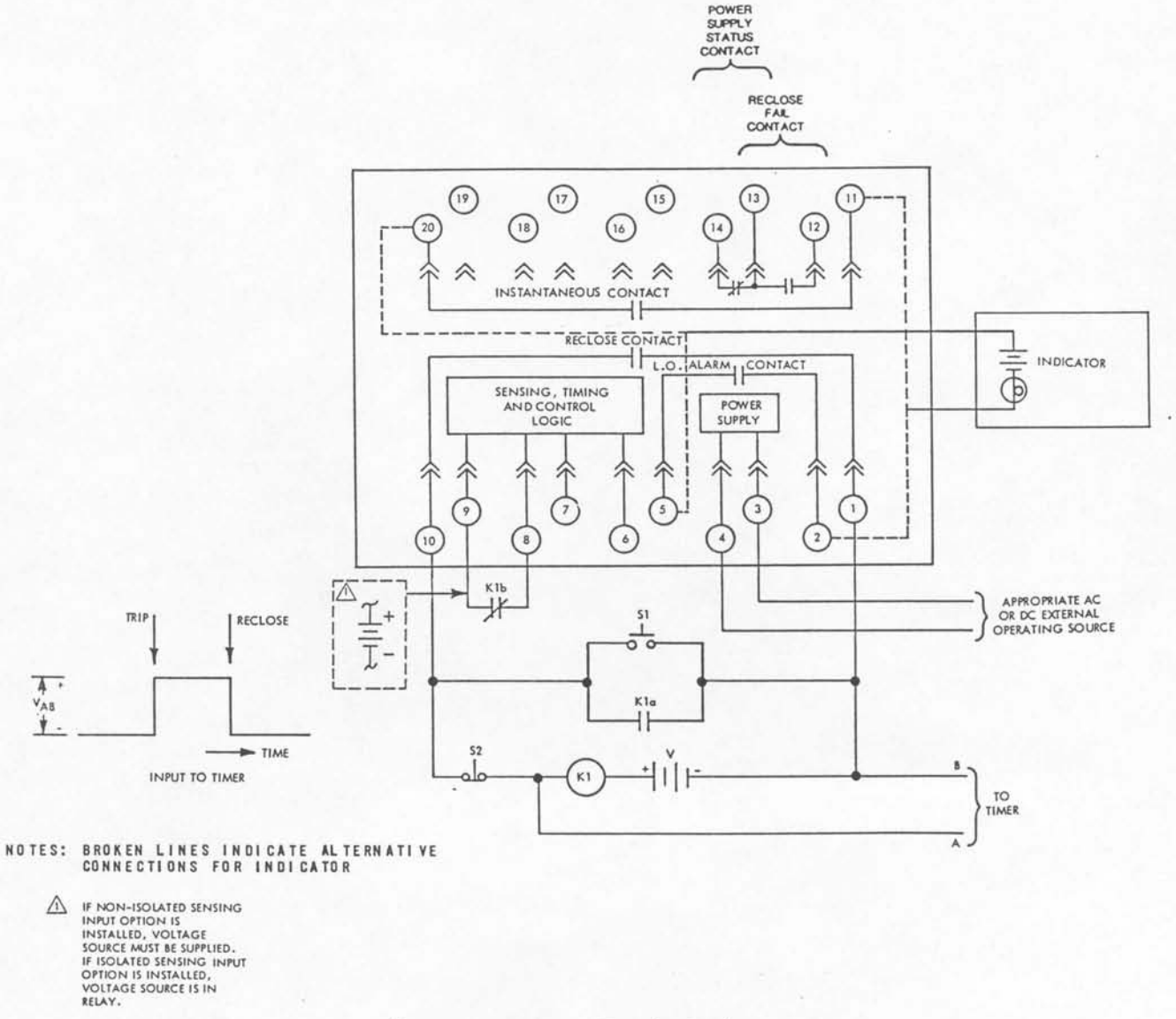
Step 2. Set control switches on relay as follows:

Switch	Position
RECLOSURE TIME DELAY 1ST, 2ND, and 3RD	0.2
INSTANTANEOUS ENABLE 1, 2, 3, 4 (if present)	OFF
LOCKOUT (if present)	4
RESET TIME (if present)	60

NOTE

To obtain an accurate reading, switch S2 must be pressed and released in less than the reclose time setting.

Step 3. Depress and release momentary contact switch S2. Timer should display 200 milliseconds $\pm$ 20 milliseconds. Check that 1ST RECLOSURE LED is lit.



NOTES: BROKEN LINES INDICATE ALTERNATIVE CONNECTIONS FOR INDICATOR

⚠1 IF NON-ISOLATED SENSING INPUT OPTION IS INSTALLED, VOLTAGE SOURCE MUST BE SUPPLIED. IF ISOLATED SENSING INPUT OPTION IS INSTALLED, VOLTAGE SOURCE IS IN RELAY.

Figure 5-1. Test Setup

Step 4. Reset timer. Repeat step 3 .

Step 5. Check that 2ND RECLOSURE LED is lit.

Step 6. Reset timer. Repeat step 3.

Step 7. Check that 3RD RECLOSURE LED is lit.

Step 8. Reset relay by momentarily pushing RESET switch up. All RECLOSURE LED's should now be out, and the RESET LED should be lit.

Step 9. Set RECLOSURE TIME DELAY 1ST, 2ND, and 3RD switches to 2.

Step 10. Reset timer.

Step 11. Depress and release momentary contact switch S2. The timer should stop at 2 seconds $\pm$0.1 seconds.

Step 12. Check that 1ST RECLOSURE LED is lit.

Step 13. Reset timer.

Step 14. Repeat step 11. 2ND RECLOSURE LED should be lit.

Step 15. Reset timer.

Step 16. Repeat step 11. 3RD RECLOSURE LED should be lit.

Step 17. Reset relay by momentarily pushing RESET switch up. All RECLOSURE LED's should now be out, and the RESET LED should be lit.

Step 18. Set RECLOSURE TIME DELAY 1ST, 2ND, and 3RD switches to 15.

Step 19. Reset timer. Depress and release momentary contact switch S2. The timer should stop at 15 seconds $\pm$0.75 seconds.

Step 20. The 1ST RECLOSURE LED should now be lit.

Step 21. Repeat step 19. 2ND RECLOSURE LED should be lit.

Step 22. Repeat step 19. 3RD RECLOSURE LED should be lit.

Step 23. Reset relay by momentarily pushing RESET switch up. All RECLOSURE LED's should now be out, and the RESET LED should be lit.

Step 24. Set RECLOSURE TIME DELAY 1ST, 2ND, and 3RD switches to 45.

Step 25. Reset timer. Depress and release momentary contact switch S2. The timer should stop at 45 seconds $\pm$2.25 seconds.

Step 26. The 1ST RECLOSURE LED should now be lit.

Step 27. Repeat step 25. 2ND RECLOSURE LED should be lit.

Step 28. Repeat step 25. 3RD RECLOSURE LED should be lit.

Step 29. Reset relay by momentarily pushing RESET switch up. All reclosure LED's should now be out, and the RESET LED should be lit.

Step 30. Set RECLOSURE TIME DELAY 1ST, 2ND, and 3RD switches to 60.

Step 31. Reset timer. Depress and release momentary contact switch S2. The timer stops at 60 seconds $\pm$3 seconds.

Step 32. The 1ST RECLOSURE LED should be lit.

Step 33. Repeat step 31. 2ND RECLOSURE LED should be lit.

Step 34. Repeat step 31. 3RD RECLOSURE LED should be lit.

Step 35. Reset relay by momentarily pushing RESET switch up.

NOTE

Steps 36 through 53 below are for relays supplied with the Instantaneous Trip Enable Ouput (ITEO) option. To continue the operational test on relays not provided with this option, proceed to Step 54.

NOTE

There are two versions of the ITEO option: A and B (as indicated by the third letter of the style number). To distinguish between them, the terms "Option A" or "Option B" are employed in Step 36. (The remaining steps apply equally to both versions.)

Step 36. Remove power from relay terminals 3 and 4, then verify that ITEO terminals 11 and 20 are open (if Option A), or closed (if Option B). Reapply power to terminals 3 and 4. (In the remaining steps there is no difference in procedure between the A and B versions of ITEO.

Step 37. Set INSTANTANEOUS ENABLE switches 2 and 4 to on, 1 and 3 to off. Verify that there is an open circuit between terminals 11 and 20.

Step 38. Depress and release momentary contact switch S2.

Step 39. Verify that there is a closed circuit between terminals 11 and 20.

Step 40. Depress and release momentary contact switch S2.

Step 41. Verify that there is an open circuit between terminals 11 and 20.

Step 42. Depress and release momentary contact switch S2.

Step 43. Verify that there is a closed circuit between terminals 11 and 20.

Step 44. Reset relay by momentarily pushing RESET switch up.

Step 45. Set INSTANTANEOUS ENABLE switches 2 and 4 to OFF and 1 and 3 to ON.

Step 46. Verify that there is a closed circuit between terminals 11 and 20.

Step 47. Depress and release momentary contact switch S2.

Step 48. Verify that there is an open circuit between terminals 11 and 20.

Step 49. Depress and release momentary contact switch S2.

Step 50. Verify that a reclosure occured and there is a closed circuit between terminals 11 and 20.

Step 51. Depress and release momentary contact switch S2.

Step 52. Verify that there is an open circuit between terminals 11 and 20.

Step 53. Set INSTANTANEOUS ENABLE switches 1 and 3 to OFF.

NOTE

Steps 54 through 67 below are for relays supplied with the lockout option. To continue the operational test on relays not provided with this option, proceed to Step 68.

Step 54. Set RECLOSURE TIME DELAY 1ST, 2ND and 3RD switches to 0.2.

Step 55. Set LOCKOUT switch to 1.

Step 56. Depress and release momentary contact switch S2. Relay K1 (in test setup) should not be energized, LOCKOUT LED should be lit, and lockout alarm contacts should be closed (i.e., terminals 1 and 5).

Step 57. Reset relay by momentarily pushing RESET switch up. Reset test set by pressing and releasing momentary contact switch S1.

Step 58. Set LOCKOUT switch to 2.

Step 59. Depress and release momentary contact switch S2 twice. Relay K1 (in test setup) should be energized when momentary contact switch is pressed the first time, and not energized when pressed the second time. Also (when switch is pressed the second time) the lockout alarm contacts should be closed and the LOCKOUT LED lit.

Step 60. Reset relay by pushing RESET switch up. Reset test set by pressing and releasing momentary contact switch S1.

Step 61. Set LOCKOUT switch to 3.

Step 62. Depress and release momentary contact switch S2 three times.

Step 63. Observe that relay K1 energizes at first and second depression of momentary contact switch and does not energize when switch is pressed the third time. LOCKOUT LED should light and lockout alarm contacts should close when switch is pressed the third time.

Step 64. Reset relay by pushing RESET switch up. Reset test set by pressing and releasing momentary contact switch S1.

Step 65. Set LOCKOUT switch to 4.

Step 66. Depress and release momentary contact switch S2 four times.

Step 67. Observe that relay K1 energizes at first, second and third depression of momentary contact switch and does not energize when switch is pressed the fourth time. LOCKOUT LED should light and lockout alarm contacts should close when switch is pressed the fourth time.

Step 68. Reset relay by pushing RESET switch up. Reset test set by pressing and releasing momentary contact switch S1.

Step 69. Set controls and switches on the relay as follows:

Control or Switch	Position
RESET TIME Switch	10
RECLOSURE TIME DELAY 1ST Switch	2

Step 70. Press and release momentary contact pushbutton S2 on test setup.

Step 71. Observe that RESET LED goes out and that 1ST RECLOSURE LED is lit. Approximately ten seconds after the automatic reclose operation, the RESET LED should return to ON.

Step 72. Set RESET TIME switch to 15.

Step 73. Repeat steps 70 and 71. Observe that RESET LED is relit in approximately 15 seconds.

Step 74. Set RESET TIME switch to 20.

Step 75. Repeat steps 70 and 71. Observe that RESET LED is relit in approximately 20 seconds.

Step 76. Set RESET TIME switch to 40.

Step 77. Repeat steps 70 and 71. Observe that RESET LED is relit in approximately 40 seconds.

Step 78. Set RESET TIME switch to 60.

Step 79. Repeat steps 70 and 71. Observe that RESET LED is relit in approximately 60 seconds.

NOTE

The following steps test for the correct operation of the Disable Contact (DC) circuit.

Step 80. Using Figures 4-6 as a guide, and taking care to observe the correct hookup procedure for isolated and non-isolated sensing, connect the relay so that the Disable Contact is closed. Note that relays with Type X power supplies require an external module (Figure 4-6).

Step 81. Check that closure of the DC sensing contact will cause the relay to ignore all further breaker operations.

NOTE

Steps 82 through 85 are for relays supplied with the reclose failure alarm option. If the relay is not provided with this option, the operational test is complete.

Step 82. Set controls and switches on the relay as follows:

Control or Switch	Position
RESET TIME Switch	60
RECLOSURE TIME DELAY 1ST Switch	2

Step 83. Reset the relay by momentarily pushing RESET switch up.

Step 84. Press and hold momentary contact pushbutton S2 on test setup.

Step 85. Observe that RECL FAIL LED is lit, and that alarm contacts (if present) are closed.

CONTINUOUS TIME DELAY TEST AND CALIBRATION

Step 1. Connect the relay as shown in Figure 5-1. With the unit in a powered-up condition, verify that the power supply status output contact is energized open (terminals 12 and 13 if equipped with this option). Remove input power and verify that the status output contact closes.

Step 2. Set controls and switches on relay as follows:

Control or Switch	Position
RESET TIME DELAY 1ST, 2ND, and 3RD	Fully CCW
1ST, 2ND, and 3RD Toggle Switches	0.2-2.0
INSTANTANEOUS ENABLE 1, 2, 3, 4 (If present)	OFF
LOCKOUT (If present)	4
RESET TIME (If present)	60

NOTE

To obtain an accurate reading, in steps 3, 5, and 6, switch S2 must be pressed and released in less than the reclose time setting.

Step 3. Depress and release momentary contact switch S2. The timer should display less than 200 milliseconds.

Step 4. Check that 1ST RECLOSURE LED is lit.

Step 5. Repeat step 3. 2ND RECLOSURE LED should be lit.

Step 6. Repeat step 3. 3RD RECLOSURE LED should be lit.

Step 7. Reset relay by momentarily pushing RESET switch up.

Step 8. Check that all RECLOSURE LED's go out and that RESET LED is lit.

Step 9. Set RECLOSURE TIME DELAY 1ST, 2ND, and 3RD controls fully clockwise.

Step 10. Depress and release momentary contact switch S2. The time display should indicate more than 1900 milliseconds.

Step 11. Check that the 1ST RECLOSURE LED is lit.

Step 12. Repeat step 10. 2ND RECLOSURE LED should be lit.

Step 13. Repeat step 10. 3RD RECLOSURE LED should be lit.

Step 14. Reset relay by momentarily pushing RESET switch up.

Step 15. Check that all RECLOSURE LED's go out and that RESET LED is lit.

Step 16. Set RECLOSURE TIME DELAY 1ST, 2ND, and 3RD controls fully counterclockwise.

Step 17. Set the range of 1ST, 2ND, and 3RD switches to 1.5-15.

Step 18. Depress and release momentary contact switch S2. The timer should display less than 1575 milliseconds.

Step 19. Check that the 1ST RECLOSURE LED is lit.

Step 20. Repeat step 18. 2ND RECLOSURE LED should be lit.

Step 21. Repeat step 18. 3RD RECLOSURE LED should be lit.

Step 22. Reset relay by momentarily pushing RESET switch up.

Step 23. Check that all RECLOSURE LED's go out and that RESET LED is lit.

Step 24. Set RECLOSURE TIME DELAY 1ST, 2ND, and 3RD controls fully clockwise.

Step 25. Depress and release momentary contact switch S2. The timer should display more than 15 seconds.

Step 26. Check that the 1ST RECLOSURE LED is lit.

Step 27. Repeat step 25. 2ND RECLOSURE LED should be lit.

Step 28. Repeat step 25. 3RD RECLOSURE LED should be lit.

Step 29. Reset relay by momentarily pushing RESET switch up.

Step 30. Check that all RECLOSURE LED's go out and that RESET LED is lit.

Step 31. Set RECLOSURE TIME DELAY 1ST, 2ND, and 3RD controls fully counterclockwise.

Step 32. Set the 1ST, 2ND, and 3RD switches to 6.0-60.

Step 33. Depress and release momentary contact switch S2. The timer should display less than 6 seconds.

Step 34. Check that the 1ST RECLOSURE LED is lit.

Step 35. Repeat step 33. 2ND RECLOSURE LED should be lit.

Step 36. Repeat step 33. 3RD RECLOSURE LED should be lit.

Step 37. Reset relay by momentarily pushing RESET switch up.

Step 38. Check that all RECLOSURE LED's go out and that RESET LED is lit.

Step 39. Set RECLOSURE TIME DELAY 1ST, 2ND, and 3RD controls fully clockwise.

Step 40. Depress and release momentary contact switch S2.

Step 41. Observe the timer displays more than 60 seconds and 1ST RECLOSURE LED lights.

Step 42. Repeat steps 40 and 41. 2ND RECLOSURE LED lights.

Step 43. Repeat steps 40 and 41. 3RD RECLOSURE LED lights.

Step 44. Reset relay by momentarily pushing RESET switch up.

NOTE

Steps 45 through 62 below are for relays supplied with the instantaneous enable option. To perform the operational test on relays not provided with this option, proceed to step 63.

Step 45. Verify that there is an open circuit between terminals 11 and 20.

Step 46. Set INSTANTANEOUS ENABLE switches 2 and 4 to ON.

Step 47. Depress and release momentary contact switch S2.

Step 48. Verify that a reclosure occurred and there is a closed circuit between terminals 11 and 20.

Step 49. Depress and release momentary contact switch S2.

Step 50. Verify that there is an open circuit between terminals 11 and 20.

Step 51. Depress and release momentary contact switch S2.

Step 52. Verify that there is a closed circuit between terminals 11 and 20.

Step 53. Reset relay by momentarily pushing RESET switch up.

Step 54. Set INSTANTANEOUS ENABLE switches 2 and 4 to OFF and 1 and 3 to ON.

Step 55. Verify that there is a closed circuit between terminals 11 and 20.

Step 56. Depress and release momentary contact switch S2.

Step 57. Verify that there is an open circuit between terminals 11 and 20.

Step 58. Depress and release momentary contact switch S2.

Step 59. Verify that a reclosure occurred and there is a closed circuit between terminals 11 and 20.

Step 60. Depress and release momentary contact switch S2.

Step 61. Verify that there is an open circuit between terminals 11 and 20.

Step 62. Set INSTANTANEOUS ENABLE switches 1 and 3 to OFF.

NOTE

Steps 63 through 78 below are for relays supplied with the lockout option. To continue the operational test on relays not provided with this option, proceed to Step 79.

Step 63. Set RECLOSURE TIME DELAY 1ST, 2ND, and 3RD controls fully counterclockwise and RECLOSURE TIME DELAY 0.2-2.0/1.5-15/6.0-60 1ST, 2ND and 3RD switches to 0.2-20.

Step 64. Set LOCKOUT switch to 1.

Step 65. Depress and release momentary contact switch S2.

Step 66. Observe that relay K1 in test setup is not energized and LOCKOUT LED lights, and lockout alarm contacts are closed.

Step 67. Reset relay by momentarily pushing RESET switch up. Reset test set by pressing and releasing momentary contact switch S1.

Step 68. Set LOCKOUT switch to 2.

Step 69. Depress and release momentary contact switch S2 twice.

Step 70. Observe that relay K1 in test setup is automatically energized when momentary contact switch is pressed the first time and not energized when momentary contact switch is pressed the second time. LOCKOUT LED lights when switch is pressed the second time and lockout alarm contacts are closed.

Step 71. Reset relay by pushing RESET switch up. Reset test set by pressing and releasing momentary contact switch S1.

Step 72. Set LOCKOUT switch to 3.

Step 73. Depress and release momentary contact switch S2 three times.

Step 74. Observe that relay K1 energizes at first and second depression of momentary contact switch and does not energize when switch is pressed the third time. LOCKOUT LED lights when switch is pressed the third time, and lockout alarm contacts are closed.

Step 75. Reset relay by pushing RESET switch up. Reset test set by pressing and releasing momentary contact switch S1.

Step 76. Set LOCKOUT switch to 4.

Step 77. Depress and release momentary contact switch S2 four times.

Step 78. Observe that relay K1 energizes at first, second and third depression of momentary contact switch and does not energize when switch is pressed the fourth time. LOCKOUT LED lights and lockout alarm contacts are closed when switch is pressed the fourth time.

NOTE

Steps 79 through 91 below are for relays supplied with the automatic reset option. To continue the operational test on relays not provided with this option, proceed to step 92.

Step 79. Reset relay by pushing RESET switch up. Reset test set by pressing and releasing momentary contact switch S1.

Step 80. Set controls and switches on the relay as follows:

Control or Switch	Position
RESET TIME Switch	10
RECLOSURE TIME DELAY 1ST Control	Fully Clockwise
RECLOSURE TIME DELAY 1ST Toggle Switch	0.2-2.0

Step 81. Press and release momentary contact pushbutton S2 on test setup.

Step 82. Observe RESET LED is out and 1ST RECLOSURE LED lights.

Step 83. Observe RESET LED lights in approximately ten seconds.

Step 84. Set RESET TIME switch to 15.

Step 85. Repeat steps 81 and 82. Observe RESET LED lights in approximately 15 seconds.

Step 86. Set RESET TIME switch to 20.

Step 87. Repeat steps 81 and 82. Observe RESET LED lights in approximately 20 seconds.

Step 88. Set RESET TIME switch to 40.

Step 89. Repeat steps 81 and 82. Observe RESET LED lights in approximately 40 seconds.

Step 90. Set RESET TIME switch to 60.

Step 91. Repeat steps 81 and 82. Observe RESET LED lights in approximately 60 seconds.

NOTE

The following steps test for the correct operation of the Disable Contact (DC) circuit.

Step 92. Using Figures 4-6 as a guide, and taking care to observe the correct hookup procedure for isolated and non-isolated sensing, connect the relay so that the Disable Contact is closed. Note that relays with Type X power supplies require an external module (Figure 4-6).

Step 93. Check that closure of the DC sensing contact will cause the relay to ignore all further breaker operations.

NOTE

Steps 94 through 96 are for relays supplied with the reclose failure alarm option. If the relay is not provided with this option, the operational test is complete.

Step 94. Set controls and switches on the relay as follows:

Control or Switch	Position
RESET TIME Switch	60
RECLOSURE TIME DELAY 1ST Control	Fully Clockwise
RECLOSURE TIME DELAY 1ST Toggle Switch	0.2-2.0

Step 95. Press and hold momentary contact pushbutton S2 on test setup.

Step 96. Observe RECL FAIL LED lights and alarm contact (if present) closes.

SECTION 6

MAINTENANCE

GENERAL

The relay is a solid-state device and requires no preventive maintenance other than a periodic operational check. The procedures in Section 5 of this manual provide an adequate check to verify proper operation of the relay. If the relay fails to function, troubleshooting procedures may be found in the service manual, or the relay may be returned to the factory for repair.

Due to the fact that most components are on conformally coated printed circuit boards, in-house replacement of individual components should not be attempted unless appropriate equipment and adequately trained personnel are available.

NOTE

It is recommended that the relay be returned to the factory for repair and recalibration due to the availability of suitable equipment and parts. If returned, the entire relay cradle should be shipped as an assembly, preferably in its case.

DISASSEMBLY

The following is a general description of the process required to disassemble Basler protective relays. It is not intended to apply to any specific relay. Therefore, in actual disassembly, care should be taken by watching for connecting cables and ribbons. For additional instructions refer to the service manual for your particular relay. Disconnect power before disassembly.

NOTE

Do not begin this procedure unless thoroughly familiar with the printed circuit handling precautions printed on page ii of this manual.

1. Remove the protective case front cover by first removing the thumbscrew located at bottom center.

2. Pull out the connecting plug(s) located above and below the drawout cradle. To aid withdrawal, a side-to-side motion, while pulling, is recommended.

3. Release top and bottom swivel latches.

4. Carefully slide the drawout cradle out of the case.

5. Remove the Phillips screws from the cradle front panel and pull panel off. Panel may be in sections.

6. To remove printed circuit boards, pull straight out. (Attempting printed circuit board component replacement is not recommended.)

The relay may be reassembled by reversing the procedure.

REPLACING PARTS

Component values may be obtained from the schematics in the Service Manual and replacement parts purchased locally. Where special components are involved (as transformers, terminal blocks, printed circuit board, etc.) B.E. part numbers may be obtained from the stamped numbers on the component or assembly, and from the schematics. These parts may be ordered directly from Basler Electric. Replacement printed circuit boards with all components mounted may be ordered by supplying the following information: (1) the complete model and style number; (2) relay serial number; (3) the board part number, serial number, and revision (REV) letter stamped on the board; and (4) the name of the board.

The quality of replacement parts must be at least equal to the type in the original circuit.

CAUTION

THE PRINTED CIRCUIT BOARDS ARE CONFORMALLY COATED AS A PROTECTION AGAINST ENVIRONMENTAL DAMAGE. GREAT CARE MUST BE EXERCISED IN PRINTED CIRCUIT BOARD COMPONENT REPLACEMENT. SPECIAL SOLDERING EQUIPMENT MUST BE USED TO HEAT AND REMOVE THE CONFORMAL COATING AND AT THE SAME TIME PREVENT DAMAGE TO THE DELICATE SOLID-STATE COMPONENT. CARE MUST ALSO BE TAKEN TO PREVENT THERMAL DAMAGE TO THE COMPONENTS AND NOT TO DAMAGE OR BRIDGE OVER THE PRINTED CIRCUIT BOARD SOLDER LANDS OR BUSSES. THE REPAIRED AREA MUST BE RECOVERED WITH A SUITABLE HIGH-DIELECTRIC PLASTIC COATING (ACRYLIC) TO PREVENT POSSIBLE BREAKDOWN ACROSS THE PRINTED BUSSES AND LANDS DUE TO MOISTURE OR DUST.

CAUTION

REMOVAL AND DIRECT SUBSTITUTION OF PRINTED CIRCUIT BOARDS OR INDIVIDUAL COMPONENTS DOES NOT NECESSARILY MEAN THE RELAY WILL OPERATE PROPERLY WITHOUT FURTHER CALIBRATION OR VERIFICATION. ALWAYS CHECK/CALIBRATE RELAY PRIOR TO PLACING RELAY INTO THE OPERATING SYSTEM.

SECTION 7

MANUAL CHANGE INFORMATION

This section contains information concerning the previous editions of the manual. At this printing, all of the substantive changes to date are indicated in the following table.

REVISION	SUMMARY OF CHANGES	REFERENCE*
A	Table 1-1: Note added concerning minimum operating voltage of Type D power supply. Page 4-2 (under "Storing"): Note added concerning electrolytic capacitors. Figure 4-6: Contact designations corrected. (K3 and K4 designation were transposed.) Drawing notes corrected accordingly. A few minor editing changes were made.	
B	Chart providing part numbers for contact sensing modules added to style chart.	
C	New option documented: The power supply status output.	
D	New option documented: Instantaneous Trip Enable option "B". Also minor editing changes.	

* An entry in this column indicates that additional information concerning the previous condition may be found on the listed page(s).

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