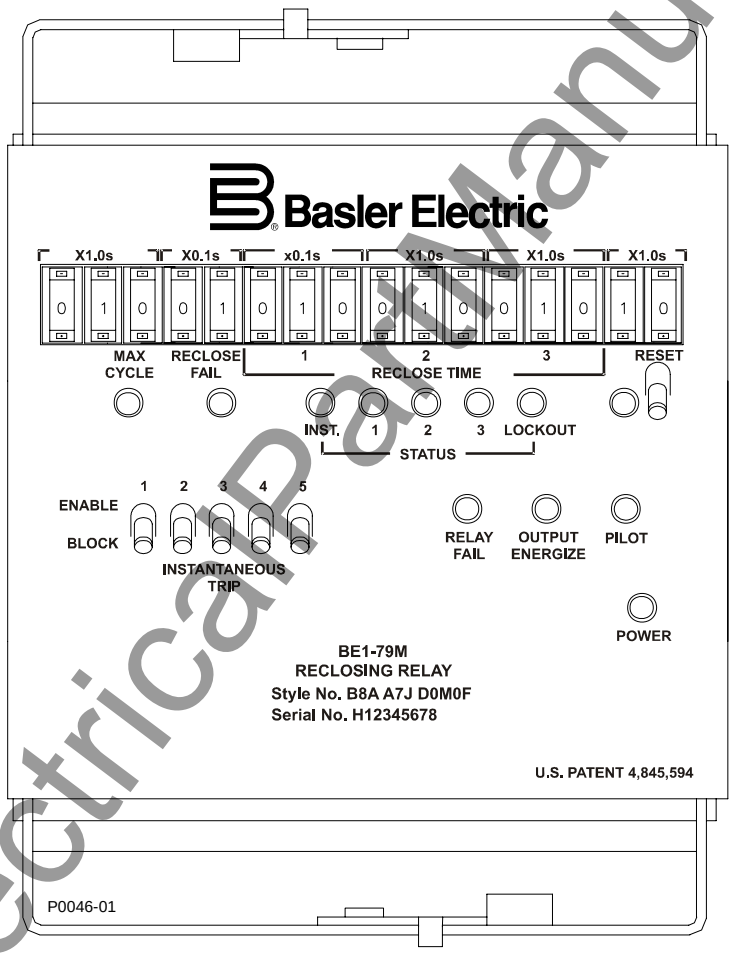
INSTRUCTION MANUAL

FOR

MULTIPLE SHOT RECLOSING RELAY

BE1-79M



Basler Electric

Publication: 9170100990
Revision: K 11/06

INTRODUCTION

This manual provides information concerning the operation and installation of the BE1-79M Multiple Shot Reclosing Relay. To accomplish this, the following is provided.

- Specifications
- Functional description
- Mounting information
- Operational Test Procedure

WARNING!

To avoid personal injury or equipment damage, only qualified personnel should perform the procedures presented in this manual.

First Printing: January 1986

Printed in USA

November 2006

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, contact Basler Electric Company, Highland, Illinois.

BASLER ELECTRIC
ROUTE 143, BOX 269
HIGHLAND, IL 62249 USA
http://www.basler.com, info@basler.com
PHONE 618-654-2341 **FAX 618-654-2351**

REVISION HISTORY

Substantive changes in this manual to date are summarized below.

Revision	Summary of Changes
A	Manual revised to reflect software changes, which introduced an additional category (Unsuccessful Reclosures) to the Reclose Event Memory.
B	Page 3-3: Subsection entitled Instantaneous Trip Enable clarified.
C	Page 3-2: Added footnote to Table 3-1. Page 3-6: Added two paragraphs beginning with "Each reclose attempt..." Page 3-7: Figure 3-2 corrected.
D	Page 3-9: Subsection entitled Reclosing Event Memory rewritten for clarification. Pages 4-2 through 4-5: Operational test procedure revised. Pages 5-2 through 5-4: Subsection entitled Test Plug Adapter added. Added qualifications to specifications listing, revised isolation test and dielectric test.
E	Operational test procedure revised. Pages 5-5 and 5-6 added. Section 6 added.
F	Manual revision to support the following relay changes. • Six additional control output options • Two additional reclose time delay options • Y-type power supply option • Reset timer 1-100 second time delay option • Four additional special contact assignment options • A four function field selectable logic switch • Moved sensing input power module from outside the case to inside the case Added Section 7, Difference Data to support BE1-79M Relay revision D and previous.
G	Changed Style Number Identification Chart first character from A to B in response to ECA 12237, changed operational Test Procedure, Section 4 to improve procedures and correct typographical error, and added old Style Number Identification Chart to Section 7.
H	Changed Introduction to include Service Manual, Publication 9 1701 00 623, and added new Figures 4-3 and 4-9.
I/01-97	Corrected Figure 1-1 by adding 7, 8 to note #2. Changed Specifications to reflect the updates in the Outputs, RFI, and Surge Withstand Capability. Clarified first paragraph on page 3-3. Changed “INST” to “2ND TIME DELAY” in Figure 3-7. Added disconnects to 20 and 11 in Figure 4-3. Revised Section 5, paragraph 1 to include both Service Manual numbers. Also corrected an error on page 5-2.

Revision	Summary of Changes
J/06-98	Deleted reference to Service Manuals. Replaced Power Supply paragraph on page 3-6 starting with "Basler Electric enhanced the power supply..." Deleted Figure 3-4 and added Table 3-3. Corrected the Figure numbering following Figure 3-4. Changed the burden data for new power supply in Table 1-2. Separated Section 4 into two sections. Now Section 5 is TESTS AND ADJUSTMENTS. Revised all numbers referring to figures, tables, and sections involved in this change. Added new dimension figures to include all options available (S1 Double-Ended and both mounting positions). Also added case ground to Figure 4-9. Changed the format of the manual.
K/11-06	Added Notes 1 and 4 to style chart in Section 1.

CONTENTS

SECTION 1 • GENERAL INFORMATION

PURPOSE

The BE1-79M Multiple Shot Reclosing Relay automatically recloses circuit breakers, which have been tripped by protective relays or other devices in power transmission and distribution systems.

- Over 90% of faults occurring on overhead lines may be cleared by momentarily de-energizing the line. Once the circuit breaker has been opened to de-energize the line, the BE1-79M provides a reliable automatic reclosure. The advantages are:
- Improved Service Continuity - returns the line to service quickly, preserving line integrity and minimizing outage effects on critical loads.
- System Stability - prevents disjointing of the system grid.
- Higher Line Loading - decreases likelihood of loss of line.

APPLICATION

Four major factors should be considered when establishing a reclosing philosophy.

- Desired number of reclosure attempts.
- Time delay between breaker opening and reclosure.
- Supervisory control.
- System coordination.

The first major factor is the desired number of reclosure attempts. Where most faults are attributable to heavy tree exposure, as in distribution networks, multiple reclosure attempts are common. This is possible because of low voltage levels and is desirable considering customer inconvenience during outages. The BE1-79M is programmable for up to four reclosure attempts per sequence. This allows tailoring of the reclosing sequence to the specific needs of the circuit.

The second major factor is the time delay between breaker opening and reclosure. On subtransmission and distribution networks, it is necessary to ensure that motors are no longer running and that local generation is off-line prior to attempting reclosure. At the same time, a rapid reclosure minimizes damage, ionization, and system shock in transmission networks. After the first reclosure attempt, additional attempts are generally delayed to allow for de-ionization of the interrupter. The BE1-79M incorporates one instantaneous reclosing attempt with bypass capability, and up to three individually adjustable, time-delayed, reclosing attempts.

A third major factor to be considered in reclosing is supervisory control. Supervisory control allows the operator to maintain control of the system at all times. The BE1-79M has inputs available to bypass the instantaneous reclose attempt and to drive the relay to LOCKOUT inhibiting relay operation at any time. In addition, a separate input is available which may be used to initiate a pilot reclosing sequence.

The fourth major factor is system coordination. The BE1-79M has outputs available which may be used to block or enable instantaneous tripping of the circuit breaker and block a transformer's automatic load tap changer operation during a reclosing sequence.

MODEL AND STYLE NUMBER

The electrical characteristics and operational features included in a specific relay are defined by a combination of letters and numbers, which constitutes the device's style number. The style number together with the model number describe the features and options in a particular device and appear on the front panel, drawout cradle and inside the case assembly. The model number BE1-79M designates the relay as a Basler Electric, Class 100, Multiple Shot Reclosing Relay.

Style Number Example

The following style number identification chart illustrates the features and options for BE1-79M relays. For example, if the style number were **BE1-79M B6A A6J C0L0F,** the device would have the following features:

BE1-79M Model Number
- **B** Multiple shot
- **6** Lockout and reset with reclose fail and maximum cycle
- **A** Instantaneous trip enable
- **A6** Reclose time delay adjustable from 0.1 to 99.9 seconds
- **J** Operating power derived from 125 Vdc or 120 Vac source
- **C** Reset time delay adjustable from 10 to 1000 seconds
- **0** Standard contact assignment
- **L** Non-isolated contact sensing
- **0** No option 3 available
- **F** Semi-flush mounting

Style Number Change

Effective November 18, 1991 (serial number 2812 and subsequent), the BE1-79M Multiple Shot Reclosing Relay, style number identification for multiple shot is changed from A to B. This style number change was made to differentiate relays with sensing input power module on the outside of the case (style number A) and relays with the sensing input power module inside the case (style number B). Section 7 of this manual provides difference data for style number A relays.

Compatibility

Relays with style number B are backwards compatible. That is, they may be used in place of relays with style number A. The only exception is for a relay with a type Z power supply (250 Vdc/230 Vac) and isolated sensing. For details, see section 7 of this manual.

Relays with style number A are NOT forward compatible. They may NOT be used in place of relays with style number B.

STYLE NUMBER IDENTIFICATION CHART

BE1–79M B □ □ — □ □ □ — □ □ □ 0 □

MODEL NO.

SENSING INPUT TYPE
- B) Multi–shot

LOCKOUT & RESET
- 1) Lockout and Reset
- 2) Lockout and Reset with Reclose Failure Alarm
- 3) Lockout and Reset with Pilot Initiate
- 4) Lockout and Reset with Maximum Cycle Time
- 5) Lockout and Reset with Reclose Failure Alarm and Pilot Initiate
- 6) Lockout and Reset with Reclose Failure Alarm and Maximum Cycle Time
- 7) Lockout and Reset with Pilot Initiate and Maximum Cycle Time
- 8) Lockout and Reset with Reclose Failure Alarm, Pilot Initiate, and Maximum Cycle Time

CONTROL OUTPUTS (4)
- 0) None
- A) Instantaneous Trip Enable – N.O. Contact
- B) Block LTC–N.C. Contact
- C) ITE–N.O. Contact Block LTC–N.C. Contact
- D) ITE–N.C. Contact
- E) ITE–N.C. Contact Block LTC–N.C. Contact
- F) ITE–N.O. (Cold Load)
- G) ITE–N.O. (cold Load) Block LTC–N.C. Contact
- H) ITE N.O. BLTC N.O.
- I) ITE N.C. BLTC N.O.

RECLOSE TIME DELAY
- A6) 0.1–99.9 sec.
- A7) 0.1–99.9 sec. (1st T.D.) 1–999 sec. (2nd & 3rd T.D.)
- A8) 0.03–0.99 sec (Pilot) 0.1–99.9 sec. (1st, 2nd & 3rd T.D.)

(2)

POWER SUPPLY
- J) 125 Vdc 100/120 Vac
- K) 48 Vdc
- L) 24 Vdc
- Y) SWITCHABLE 48Vdc OR 125Vdc
- Z) 250 Vdc 230 Vac

RESET TIMER
- C) Time Delay 10–1000 sec
- D) Time Delay 1–100 sec

OPTION 1 SPECIAL CONTACT ASSIGNMENT
- 0) Standard
- 1) Reset Inhibit (3)
- 2) Reclose Wait
- 3) Pre–Lockout (3)
- 4) Reclose Permissive

OPTION 2
- L) Non–Isolated Contact Sensing Input (1)
- M) Isolated Contact Sensing Input

OPTION 3
- 0) None

OPTION 4
- F) Semi–Flush Mounting
- P) Projection Mounting

BE1–79M
D677–004
1–17–97

NOTE:

(1) Non–Isolated contact sensing L requires dc sensing power

(2) Pilot Initiate Option required (L.O. & Reset must be 3, 5, 7, 8)

(3) Not available with Pilot Initiate (L.O. & Reset must be 1, 2, 4, or 6)

(4) ITE NO/NC – See Section 3, Functional Description

Figure 1-1. Style Number Identification Chart

SPECIFICATIONS

The BE1-79M Relay is available with the following features and capabilities.

Contact Sensing
Reclose Initiate
Breaker (52b)
Pilot Initiate
Instantaneous Reclose Bypass
Drive to Lockout

The contact sensing circuits require user-supplied contacts with a minimum rating of 0.025 A at 250 Vdc. Sensing current is supplied by the relay in styles with isolated sensing. Styles with non-isolated sensing require an applied sensing voltage equal to the relay dc power supply input rating. Burden per contact for non-isolated sensing, dependent on power supply type, is listed in Table 1-1.

Power Supply

Refer to Table 1-2.

Outputs

Output contacts are rated as follows:

Resistive

120 Vac	Make, break, and carry 7 Aac continuously.
250 Vdc	Make and carry 30 Adc for 0.2 seconds, carry 7 Adc continuously, break 0.3 Adc.
500 Vdc	Make and carry 15 Adc for 0.2 seconds, carry 7 Adc continuously, break 0.3 Adc.

Inductive

120 Vac, 125 Vdc, 250 Vdc Break 0.3 A (L/R = 0.04)

Timing

Reclose

Adjustable from 00.1 to 99.9 seconds in 0.1 second increments. Accurate within 1% of setting or 0.05 seconds, whichever is greater. Optionally adjustable from 1 to 999 seconds in one second increments for the second and third reclose time delays. Accurate within 1% of setting or 0.5 seconds, whichever is greater.

Pilot (Optional)

Optionally adjustable from 0.03 to 0.99 seconds in 0.01 increments. Accurate to within 0.005 seconds of setting. If reclose time delay option A8 is not specified, pilot reclose time is less than 0.030 seconds.

Reset

Adjustable from 10 to 1,000 seconds in 10-second increments or optionally adjustable from 1 to 100 seconds in 1 second increments. A setting of 00 indicates a 1000 second reset time or optionally a 100 second reset time. Accurate within 1% of setting or 0.5 seconds, whichever is greater.

Reclose Fail (Optional)

Adjustable from 0.1 to 9.9 seconds in 0.1 second increments. Accurate within 1% of setting or 0.05 seconds, whichever is greater.

Maximum Cycle (Optional)

Adjustable from 1 to 1000 seconds in 1 second increments. Accurate within 1% of setting or 0.5 seconds, whichever is greater.

Temperature

Operating	-40°C (-40°F) to 70°C (158°F)
Storage	-65°C (-85°F) to 100°C (212°F)

Radio Frequency Interference (RFI)

Maintains proper operation when tested for interference in accordance with IECC C37.90.2-1989, *Trial-Use Standard Withstand Capability of Relay Systems to Radiated Electromagnetic Interference from Transceivers,* and 99-1188, field tested using a 5 watt, hand held transceiver operating at random frequencies centered around 144 MHz and 440 MHz, with the antenna located 6 inches from the relay in both horizontal and vertical planes.

Shock

In standard tests, the relay has withstood 15g in each of three mutually perpendicular planes without structural damage or degradation of performance.

Vibration

In standard tests the relay has withstood 2g in each of three mutually perpendicular planes swept over the range of 10 to 500 Hz for six sweeps, 15 minutes each sweep, without structural damage or degradation of performance.

Isolation

At terminals 1 through 4 and 11 through 20, the maximum voltage applied must be no greater than 300 V because of the MOV suppressors employed at these locations. At the remaining terminals, 2,500 Vac at 60 Hz for one minute may be applied in accordance with IEC 255-5 and ANSI/IEEE C37.90-1989 (Dielectric Test).

Surge Withstand Capability

Oscillatory	Qualified to ANSI/IEEE C37.90.1-1989 Standard Surge Withstand Capability (SWC) Tests for Protective Relays and Relay Systems.
Fast Transient	Qualified to ANSI/IEEE C37.90.1-1989 Standard Surge Withstand Capability (SWC) Tests for Protective Relays and Relay Systems.

Impulse Test

Qualified to IEC 255-5.

GOST-R Certification

GOST-R certified No. POCC US.ME05.B03391; complies with the relevant standards of Gosstandart of Russia. Issued by accredited certification body POCC RU.0001.11ME05.

Weight

13 pounds

Case Size

S1

Table 1-1. Burden (Nominal) Per Non-isolated Sensing Contact

Power Supply Type	K	J	L	Z
Nominal Burden Per Input	0.75 W	1.60 W	0.70W	2.20 W

NOTE: For type Y Power supply, use burden for type K or type J power supply depending on nominal operating voltage.

Table 1-2. Power Supplies

Type	Nominal Input Voltage	Input Voltage Range	Burden at Nominal (Maximum)
K (Mid Range)	48 Vdc	24 to 150 Vdc	5.4 W
J (Mid Range)	125 Vdc 120 Vac	24 to 150 Vdc 90 to 132 Vac	5.3 W 13.2 VA
L (Low Range) *	24 Vdc	12 to 32 Vdc	5.3 W
Y (Mid Range)	48 Vdc 125 Vdc	24 to 150 Vdc 24 to 150 Vdc	5.4 W 5.3 W
Z (High Range)	250 Vdc 240 Vac	62 to 280 Vdc 90 to 270 Vac	5.4 W 14.1 VA

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

SECTION 2 • HUMAN-MACHINE INTERFACE

CONTROLS AND INDICATORS

Figure 2-1 illustrates the location of controls and indicators on the front panel. Table 2-1 explains the call-outs shown in Figure 2-1. Table 2-2 lists the functions enabled per logic switch (S23) position.

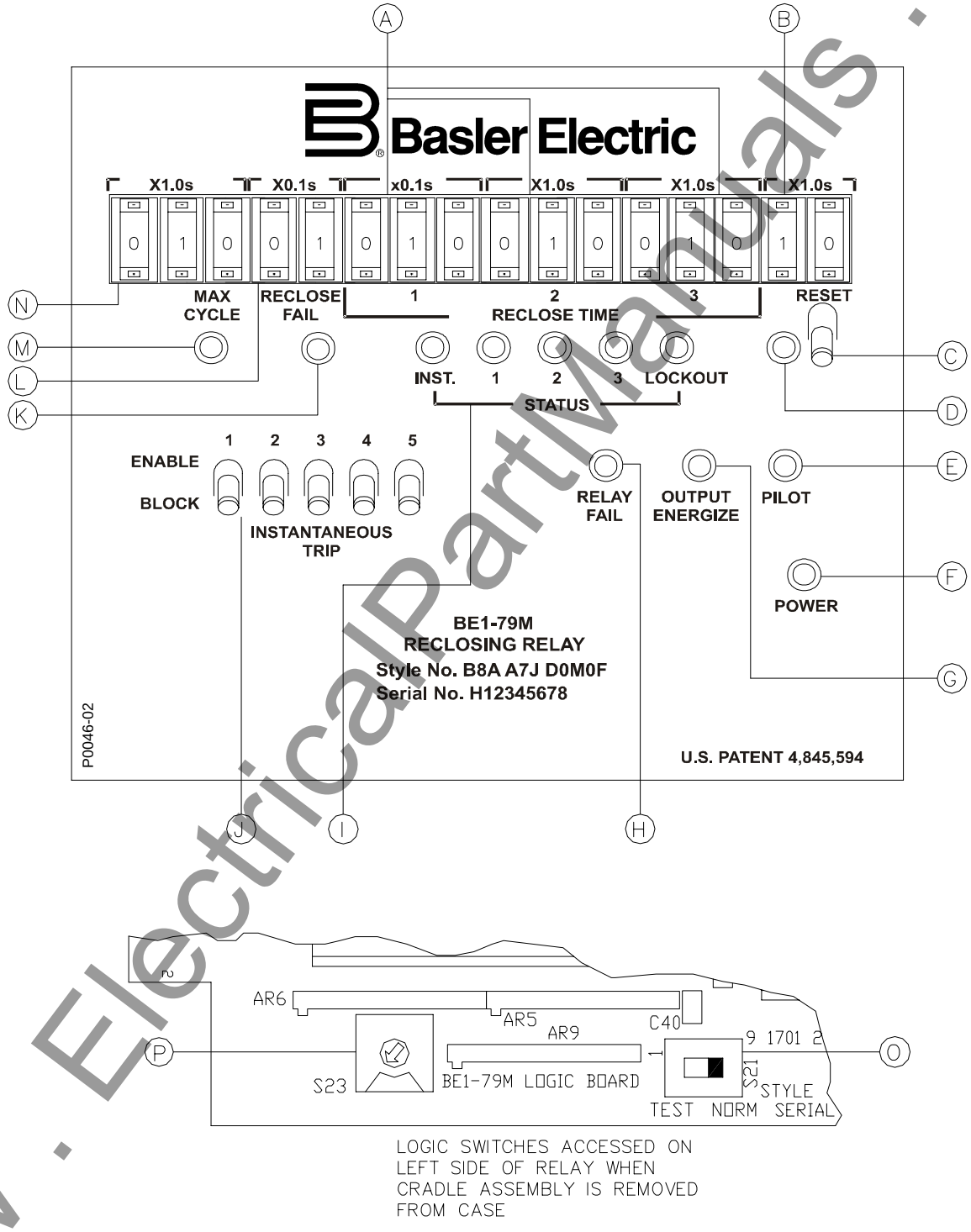


Figure 2-1. Location of Controls and Indicators

Table 2-1. BE1-79M Controls and Indicators (Refer to Figure 2-1)

Locator	Control or Indicator	Function
A	**RECLOSE TIME** Controls (1, 2, 3)	Establish reclose time delays for corresponding time-delayed reclosure attempts. Individually thumbwheel adjustable from 00.1 to 99.9 seconds in 00.1 second increments or if reclose time delay option is A7, second and third RECLOSE TIME thumbwheels are adjustable from 001 to 999 seconds in one second increments. A setting of 000 on a RECLOSE TIME thumbwheel indicates the reclosing attempt is not desired and sends the relay to lockout at this point in the reclosing sequence.
B	**RESET** Control	Establishes automatic reset interval. Thumbwheel adjustable from 10 to 1000 seconds in 10 second increments. Optionally adjustable from 1 to 100 seconds in 1 second increments. A setting of 00 indicates a reset time of 1000 seconds or optionally, 100 seconds.
C	**RESET** Switch	Momentary toggle switch, which extinguishes STATUS LEDs (except LOCKOUT). Accessible by linkage, which extends through bottom of front cover.
D	**RESET** LED	ON when relay is in RESET.
E	**PILOT** or **RESET INHIBIT** LED (Optional)	With **PILOT** option, LED is ON when pilot output relay coil is energized. Remains ON until activation of manual RESET lever, power loss, or when relay reaches RESET if STATUS LED reset is optionally selected by logic switch S23. With **RESET INHIBIT** option, LED is ON when reset inhibit input is closed.
F	**POWER** LED	ON when the power supply is delivering a nominal ±12 Vdc to internal circuitry.
G	**OUTPUT ENERGIZE** LED	ON when reclose output relay coil is energized.
H	**RELAY FAIL** LED	ON when relay is not operable. Also ON during power-up sequence.
I	**STATUS** LEDs (**INST., 1, 2, 3)** **(LOCKOUT)**	Latched ON to indicate progression of reclosing sequence. Extinguished by RESET lever, power loss, or when relay reaches RESET if STATUS LED reset is optionally selected by logic switch S23. ON when relay is in LOCKOUT. (Non-latching.)
J	**INSTANTANEOUS TRIP** (Optional)	Five toggle switches, which enable or block instantaneous tripping of circuit breaker. Numbers correspond to the relay state or a specific trip depending on the type of reclosing sequence in progress.
K	**RECLOSE FAIL** LED (Optional)	ON when circuit breaker 52b contact does not open within selected time after reclose output has been energized.
L	**RECLOSE FAIL** Control (Optional)	Limits duration of reclose command signal. Thumbwheel adjustable from 0.1 to 9.9 seconds in 0.1 second increments. For a setting of 00, the reclose command signal is continuous until the breaker closes.
M	**MAX. CYCLE** LED (Optional)	ON when maximum cycle limit, as established by the MAX. CYCLE control, has been exceeded.

Locator	Control or Indicator	Function
N	**MAX. CYCLE** or **PILOT TIME** Control (Optional)	With MAX. CYCLE, establishes maximum cycle limit (maximum allowable interval from initiation of reclosing sequence until RESET or LOCKOUT). Thumbwheel adjustable from 1 to 1000 seconds in 1 second increments. A setting of 000 allows a 1000-second maximum cycle. With reclose time delay option A8 (PILOT TIME), the two least significant digits are used for the pilot time delay for a pilot reclose attempt. Thumbwheel adjustable from 0.03 to 0.99 seconds. A setting of .00, .01, and .02 is equivalent to .03 setting.
O	**NORMAL/TEST** Switch	Provides selection of relay operating mode.
P	Logic Switch	Field selectable, 16 position switch (S23) enables combinations of the following functions. • Memory save • Power-up to reclose • Recognition dropout • Status LED reset Refer to Table 2-2 for switch positions and functions enabled. To be enabled, function changes require relay power removal and power-up after setting switch position.

CAUTION

With Power-up to Reclose enabled, relay will close the breaker during power-up if relay was in RESET when powered-down and Pilot Initiate or Reclose Initiate is present during power-up.

Table 2-2. Logic Switch (S23) Positions and Functions Enabled

Position	Functions Enabled			
0**				
1				RD
2			SL	
3			SL	RD
4		PR*		
5		PR*		RD
6		PR*	SL	
7		PR*	SL	RD
8	MS			
9	MS			RD
A	MS		SL	
B	MS		SL	RD

Position	Functions Enabled			
C	MS	PR*		
D	MS	PR*		RD
E	MS	PR*	SL	
F	MS	PR*	SL	RD

NOTES:

** Default position from factory
RD = Recognition Dropout
SL = Status LED Reset
PR* = Power-up to Reclose (Refer to Caution preceding Table 2-2)
MS = Memory Save

SECTION 3 • FUNCTIONAL DESCRIPTION

GENERAL

The BE1-79M Multiple Shot Reclosing Relay is a microprocessor-based device, which responds to the state of external contacts. In responding, the Relay provides automatic reclosure once the circuit breaker has opened to de-energize the line. Refer to Section 1 for major factors to consider when establishing a reclosing philosophy.

FUNCTIONAL DESCRIPTION

The following paragraphs describe the Relay circuit functions illustrated in Figure 3-1.

Contact Sensing

Depending on style, contact-sensing current is obtained either directly from the Multiple Shot Reclosing Relay or from any power source with a voltage rating the same as the Relay power supply dc input voltage. When the Relay provides the contact sensing current, isolated contact sensing is employed. When another power source provides the contact sensing current, non-isolated contact sensing is employed. Relays with a Y type wide range power supply have a field selectable link (J2) on the contact sensing board to match the nominal power supply input voltage of 48 Vdc or 125 Vdc. Selection must be done at the time of installation and prior to application of power. This option is factory set for 125 Vdc. Figure 3-2 shows the link set to the 125 Vdc position.

Table 3-1. Function of Sensing Contacts

Contacts	Designation	Function
Pilot Initiate (Optional) (Note Δ1)	PI	Form A contact which, when closed, initiates a pilot reclosing (Optional) sequence. This contact is also required during the sequence to initiate each reclose attempt.*
Breaker	52b	Form B auxiliary contact of the controlled breaker utilized to determine the state of the breaker.
Reclose Initiate (Note Δ2)	RI	Form A contact which, when closed, initiates a normal reclosing sequence. This contact is also required during the sequence to initiate the individual time delays and subsequent reclose output closures.*
Instantaneous Reclose Bypass	IRB	Form A contact which, when closed, cause the instantaneous reclosure attempt to be bypassed.
Drive to Lockout	DTL	Form A contact which, when closed, instantaneously drives the Multiple Shot Reclosing Relay into lockout.

NOTES:

* If the appropriate initiate contact (RI or PI) is not received within the corresponding period, the relay is forced to the lockout state.

Δ1. Input is Reset Inhibit (RES INH) if option 1 is 1.

Δ2. Input is Reclose Wait (REC WAIT) if option 1 is 2. Input is Reclose Permissive (RP) if option 1 is 4.

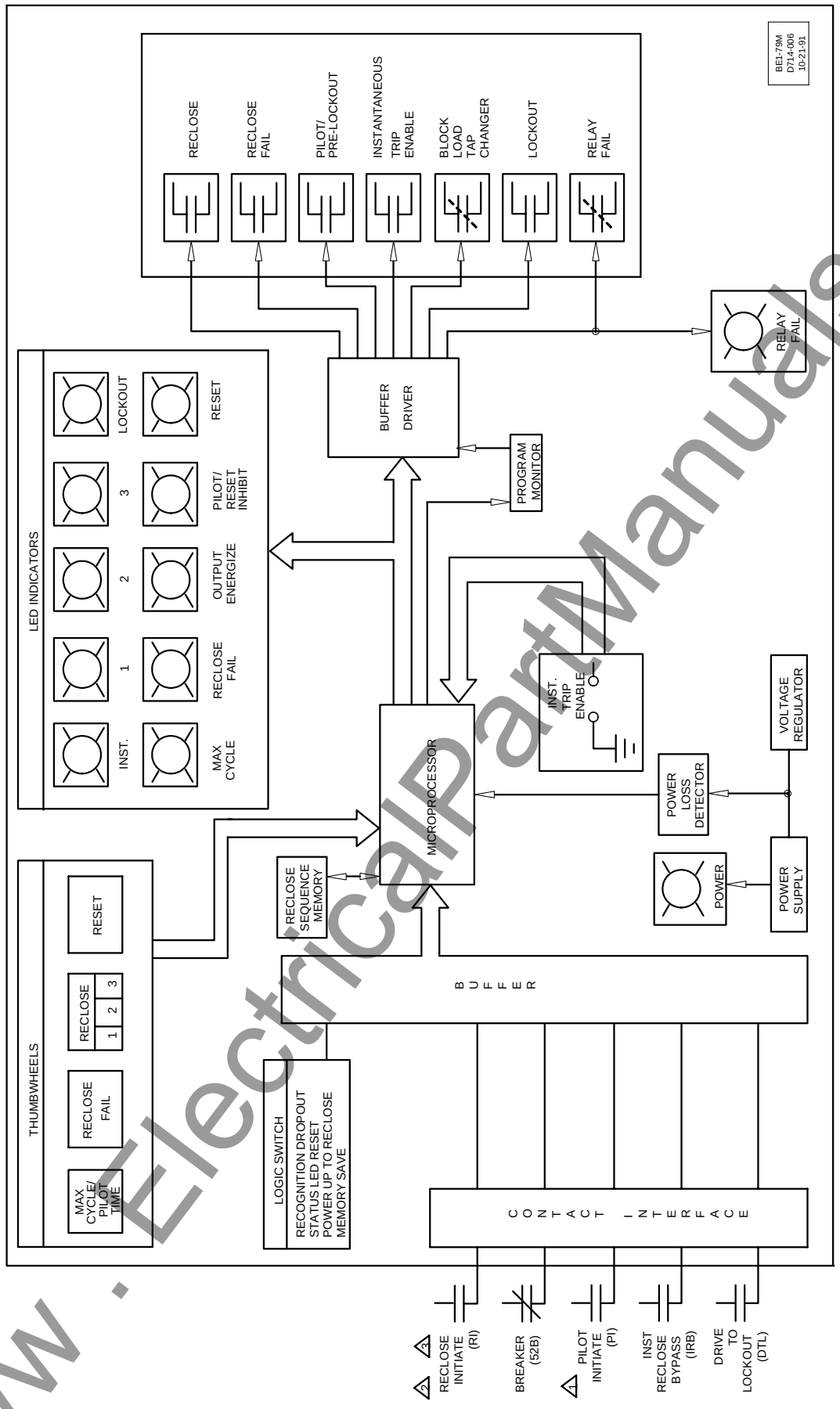


Figure 3-1. Functional Block Diagram

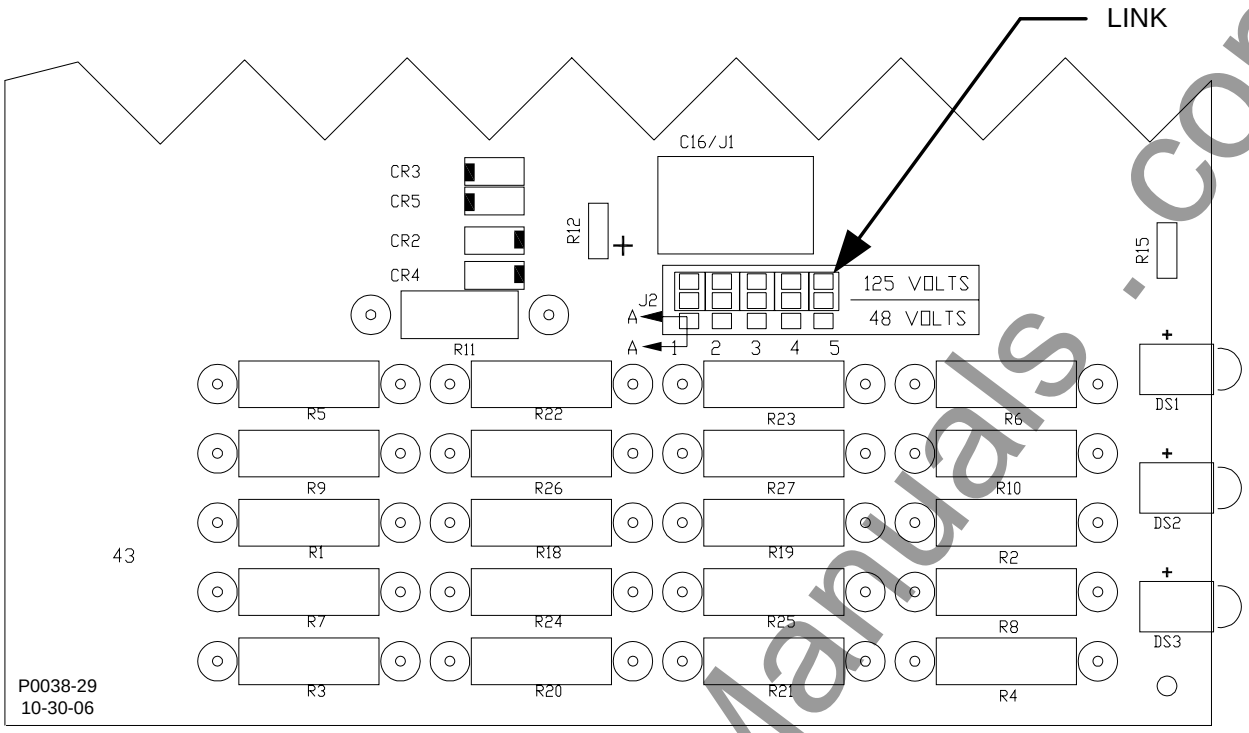


Figure 3-2. Contact Sensing Board Link Position

Recognition and response to closure of the sensing contacts is time dependent. All contact sensing inputs must be present for a minimum of 6 milliseconds before recognition. For a reclosing sequence to begin, the 52b contact closure must occur within 17.5 milliseconds after either RI or PI has dropped out. For a longer output recognition (200 milliseconds), logic switch S23 provides a field selectable option (recognition dropout). If RI and PI are initiated simultaneously, PI takes priority. If a Pilot reclosing sequence is initiated, IRB has no effect. DTL overrides all other inputs. The function of each set of sensing contacts is described in Table 3-1.

Contact Interface

Contact interface circuits provide current limiting, filtering, and optoisolation. This interfacing translates the state of the individual sensing contacts to logic levels. These logic levels are entered onto the data bus, via buffers, for use by the microprocessor.

Logic Switch

Logic switch S23, is a field selectable, 16-position switch (0 through F), that enables any combination of four functions. Refer to Table 2-2 for logic switch positions and functions enabled. The four functions are Memory Save, Power-up to Reclose, Recognition Dropout, and Status LED Reset.

- Memory Save - When power is lost, the relay initiates the memory circuit to store the exact point at which the reclosing sequence was interrupted. Within 100 milliseconds of when power is reapplied, the relay will resume the reclosing sequence. Memory save function will occur ONLY if the relay was in a reclosing sequence. It will not occur if the relay was in RESET, RELAY FAIL, or LOCKOUT.

- Power-up to Reclose - When power is lost during a RESET condition, the relay initiates a first programmed reclose after power is restored if the breaker is open (52b) and normal initiate (RI or PI) is present.

- Recognition Dropout - This function replaces the standard recognition dropout time of 17.5 milliseconds. The relay initiates a reclosing sequence if a 52b occurs within 200 milliseconds of an RI or PI. Figure 3-3 illustrates the recognition dropout timing relationship.

- Status LED Reset - After a reclosing sequence, the relay initiates STATUS LED reset (INST., 1, 2, 3, and PILOT) when the relay reaches RESET.

Switch S23, on the edge of the contact sensing board, is accessible by removing the drawout cradle from the case. When S23 is changed to select different functions, the relay must be powered down and power reapplied to enable selected functions.

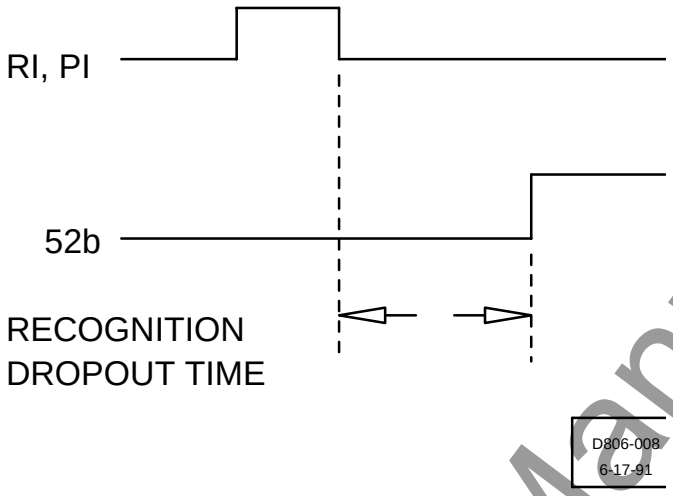


Figure 3-3. Recognition Dropout Timing

Thumbwheels

Front panel thumbwheel switches allow the user to program various time settings and limit reclosure attempts. The switches select individual diodes, producing binary coded decimal words, which are read by the microprocessor.

Instantaneous Trip Enable (Optional)

Five front panel toggle switches allow the user to select ENABLE or BLOCK instantaneous tripping of the circuit breaker. Instantaneous tripping may be enabled or disabled for any single trip or combination of trips. The microprocessor interrogates the individual switches at appropriate times to determine the desired state of the instantaneous trip enable output contacts. When LOCKOUT or RESET occurs and normally open ITE, the instantaneous trip enable output contacts are closed while the breaker is closed if instantaneous trip enable switch 1 is in the enable position.

Microprocessor

The BE1-79M uses an 8-bit, low power, CMOS microprocessor which performs all timing and decision-making functions.

Program Monitor

Operation of the microprocessor is monitored by the program monitor. In normal operation, the microprocessor outputs pulses at regular intervals. If these pulses are disrupted, the program monitor stops microprocessor operation and forces the output buffers to high impedance. This causes all output contacts to assume their normal states and lights the RELAY FAIL LED. If this situation is the result of something other than hardware failure, it may be remedied by momentarily interrupting operating power.

Power Loss Detector

The power loss detector circuit compares the output of the power supply to a reference voltage. If the power supply output falls below the reference voltage, the power loss detector circuit sends an interrupt signal to the microprocessor. Upon receipt of this signal, the microprocessor stores status data in the non-volatile reclose sequence memory. This data indicates the progression of a reclosing sequence or

state of the Multiple Shot Reclosing Relay at the time power was lost. At this point, the relay fail contacts close and all further functions of the relay cease until input power is removed and restored. When power is restored, the microprocessor uses this data, if logic switch S23 memory save function is enabled and the power loss occurred during a reclosing sequence, to resume operation from the point of power loss. The relay compensates for any change of state of the breaker which may have occurred during power off. However, the remaining least significant digits of the maximum cycle time, reclose delay time, and the remaining reclose fail time are not stored. If the two most significant digits of the remaining maximum cycle time at power loss are 00, the least significant digit is seen as 9 on power restoration. If the relay is in RESET when power is lost and logic switch S23 power-up to reclose function is enabled, the relay will close the breaker during power-up if RI or PI is present.

Outputs

Output commands from the microprocessor light LED indicators and are amplified by driver circuits to energize the coils of the output relays. Individual output contacts and their functions are listed in Table 3-2.

Table 3-2. Output Contacts

Output Contacts	Function
Reclose	Normally open contacts are closed to energize the closing coil of the controlled circuit breaker.
Lockout	Normally open contacts are closed to indicate lockout.
Relay Fail	Normally closed contacts will be closed to indicate a malfunction of the microprocessor or power supply. (These contacts open on the completion of the power-up sequence.)
Reclose Fail (Optional)	Normally open contacts are closed to indicate that the breaker has not responded to the reclose command output in the allotted time.
Pilot (Optional)	Normally open contacts are closed to energize the closing coil of the controlled circuit breaker on the first reclosure attempt of a pilot initiated reclosing sequence.
Pre-lockout (Optional)	Normally open contact that is closed to signify that the last programmed reclose attempt is taking place.
Instantaneous Trip Enable (Optional)	Normally open or normally closed contacts change state to enable an instantaneous tripping scheme during the reclosing sequence. These contacts are controlled by the front panel switches and the selected reclosing sequence. A normally open ITE will close to enable instantaneous tripping, and a normally closed ITE will open to enable instantaneous tripping.
Block Load Tap Changer (Optional)	Normally closed or normally open contacts change state to disable automatic load tap changer operation during a reclosing sequence.

Power Supply

Basler Electric enhanced the power supply design for unit case relays. This new design created three, wide range power supplies that replace the four previous power supplies. Style number identifiers for these power supplies have not been changed so that customers may order the same style numbers that they ordered previously. The first newly designed power supplies were installed in unit case relays with EIA date codes 9638 (third week of September 1996). A benefit of this new design increases the power supply operating ranges such that the 48/125 volt selector is no longer necessary. Specific voltage ranges for the three new power supplies and a cross reference to the style number identifiers are shown in Table 3-3.

Relays with a Y type power supply also have a field selectable link (J2) on the contact sensing board to match the power supply nominal input voltage of 48 Vdc or 125 Vdc. The contact sensing functional description at the beginning of this section described the field selectable link J2.

Table 3-3. Wide Range Power Supply Voltage Ranges

Power Supply	Style Chart Identifier	Nominal Voltage	Voltage Range
Low Range	L	24 Vdc	12∗ to 32 Vdc
Mid Range	J, K, Y	48, 125 Vdc, 120 Vac	24 to 150 Vdc, 90 to 132 Vac
High Range	Z	125, 250 Vdc, 120, 240 Vac	62 to 280 Vdc, 90 to 270 Vac

∗ 14 Vdc required to start the power supply.

Relay operating power is developed by the wide range, isolated, low burden, flyback switching, solid-state power supply. Nominal +/- 12 Vdc is delivered to the relay internal circuitry. Input (source voltage) for the power supply is not polarity sensitive. A red LED turns **ON** to indicate that the power supply is functioning properly.

OPERATIONAL CHARACTERISTICS

Due to the microprocessor-based design of the BE1-79M Multiple Shot Reclosing Relay, many of its operational characteristics are not apparent in the block diagram. The remaining information in this section is focused on the software-controlled features of the relay.

Power-Up

The application of operating power results in one of four states as illustrated in Figure 3-4. Depending on conditions and the RESET delay setting, the interval from power application to the resultant state may be from 10 to 1000 seconds or optionally from 1 to 100 seconds. When the resultant state is reached, the relay fail output contacts open and the RELAY FAIL LED is extinguished.

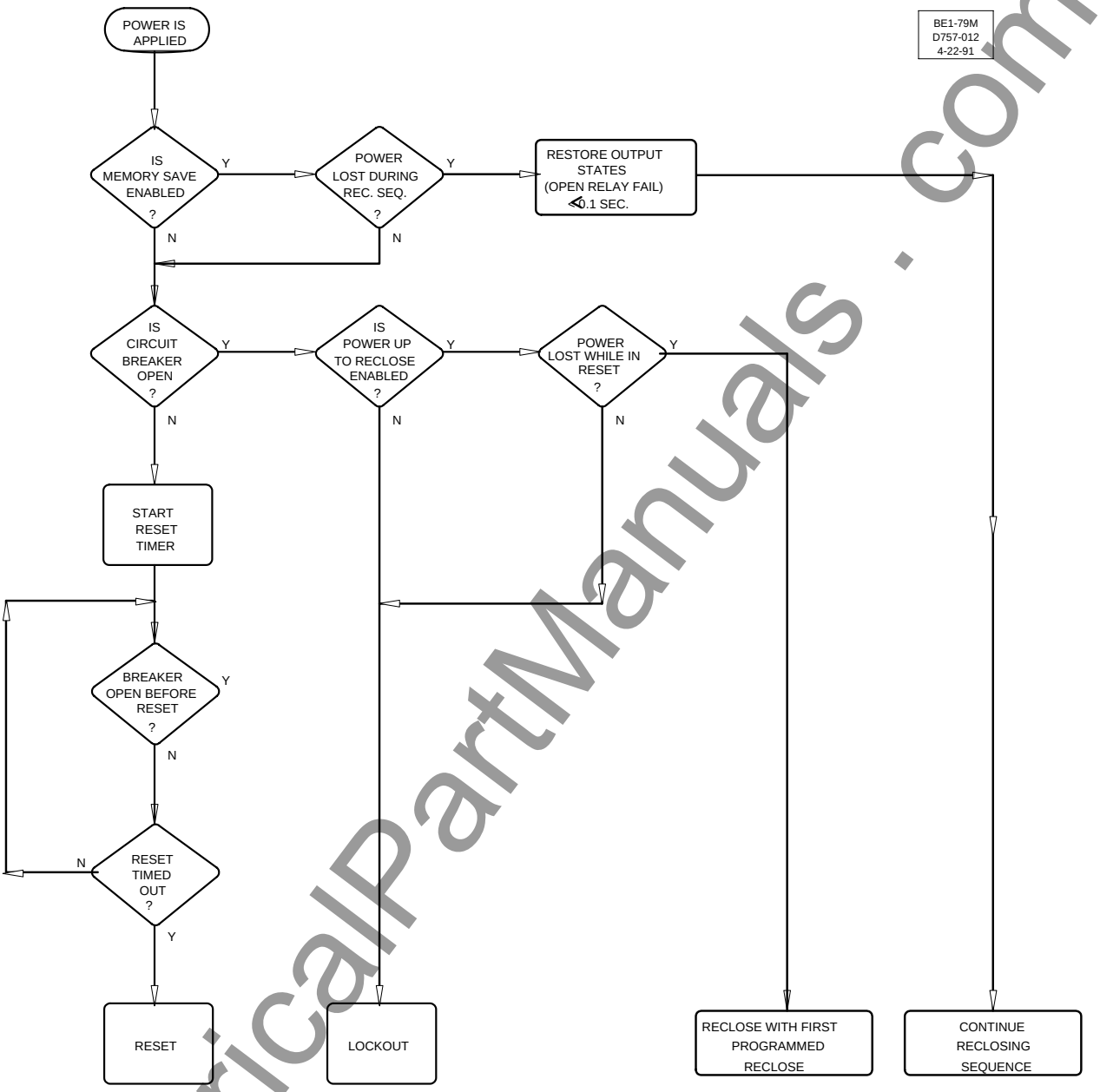


Figure 3-4. Power-up Flow Chart

RESET

A reclosing sequence may only be initiated when the relay is in RESET. RESET is indicated by a front panel LED. For the relay to reach RESET, the controlled breaker must remain closed for the duration of the reset time delay setting. If the breaker reopens prior to this time, the relay will proceed to the next reclosing attempt. If the number of programmed reclosing attempts have been exhausted, the relay will drive to LOCKOUT.

LOCKOUT

LOCKOUT, a state inhibiting relay operation, is produced by any of the following conditions:

- Number of breaker openings exceeds the number of programmed reclosure attempts
- Closure of the drive-to-lockout input contacts
- Reclose failure
- Duration of a reclosing sequence exceeds the maximum cycle setting

The lockout output contacts close and the LOCKOUT LED lights to indicate lockout. LOCKOUT is terminated when the controlled breaker is closed (manually or by other means) and remains closed for the duration of the reset time delay setting.

Reclosing Sequences

The BE1-79M Multiple Shot Reclosing Relay can generate three types of reclosing sequences. Each type is described in the following paragraphs and illustrated in Figures 3-5 and 3-6.

- Reclose Initiated Sequence - Initiated by the 52b and RI signals, this sequence produces one instantaneous reclosing attempt followed by up to three time-delayed reclosing attempts. All reclose command outputs occur through the reclose output contacts in this sequence.
- Reclose Initiated Sequence with Instantaneous Reclose Bypass - Initiated by the 52b, RI, and IRB signals, this sequence produces up to three time-delayed reclosing attempts. All reclose command outputs occur through the reclose output contacts in this sequence.
- Pilot Initiated Sequence - Initiated by the 52b and PI signals, this sequence produces one instantaneous reclosing attempt through the pilot output contacts, and up to two time-delayed reclosing attempts through the reclose output contacts. The time-delayed reclosing attempts are controlled by RECLOSE TIME delay settings 2 and 3. RECLOSE TIME delay setting 1 is bypassed in this sequence (unless set to 000, in which case the relay drives to LOCKOUT). The IRB signal has no influence on this sequence.

Each reclose attempt requires the presence of either the RI or PI contact input before the respective reclose sequence can be performed. The RI input must also be present prior to each individual time delay.

When a Pilot Initiated reclose sequence has been started by the presence of the PI input, the associated closure of the reclose output relay also requires the presence of the PI input. If the breaker re-opens after the instantaneous closure of the reclose output relay, then the RI or PI input must be present in order for the second reclose time delay to occur. The RI or PI input must also be present for the third time delay.

The flow chart of Figure 3-6 is a simplified representation of reclosing sequence initiation and progression. In actual operation all reclosing attempts are continuous (as indicated by the dashed lines) unless limited by the reclose fail or maximum cycle options. The number of reclosing attempts may be limited by adjusting any one of the reclose time delay settings to 000. This produces LOCKOUT when a breaker trip occurs at this point in a reclosing sequence.

Reclose Fail

The reclose fail option allows the user to limit the duration of reclose command outputs. If the breaker fails to respond to the reclose command in the allotted time, the reclose fail and lockout contacts close and their associated LEDs light. The first reclosure attempt in a pilot initiated reclosing sequence is continuous regardless of the reclose fail setting. All reclose command outputs are continuous if the reclose fail option is not present or if the RECLOSE FAIL setting is 00.

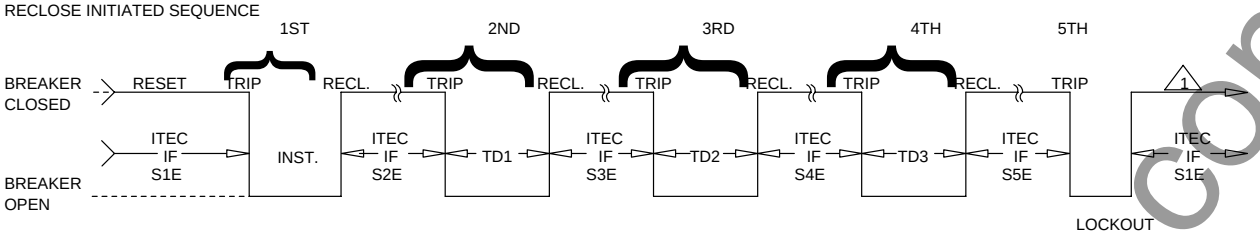
Maximum Cycle

The maximum cycle option limits the duration of a reclosing sequence as determined from sequence initiation (presence of 52b and RI or PI) to automatic relay RESET or LOCKOUT. If RESET or LOCKOUT is not reached in the allotted time, the MAX. CYCLE LED lights and the relay drives to LOCKOUT.

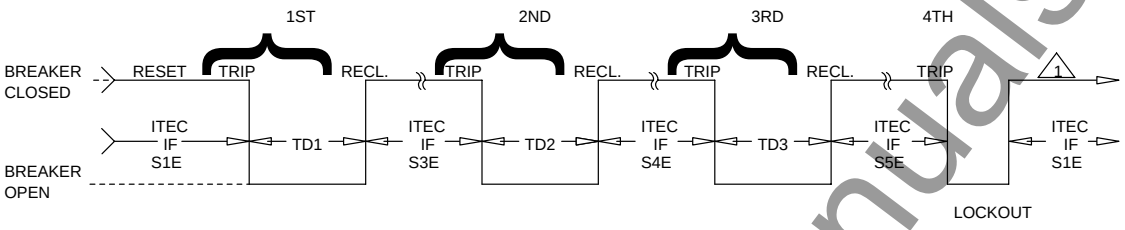
Block Load Tap Changer

The optional block load tap changer output contacts are opened to disable automatic transformer load tap changer operations while a reclosing sequence is in progress.

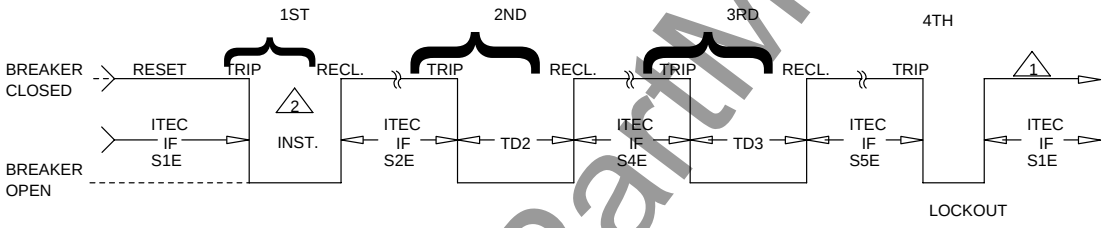
RECLOSE INITIATED SEQUENCE



RECLOSE INITIATE SEQUENCE WITH INSTANTANEOUS RECLOSE BYPASS SIGNAL



PILOT INITIATED SEQUENCE



NOTES:

1. IF CONTROL OUTPUT IS "F" OR "G", ITEC WILL BE OPEN.
2. IF RECLOSE TIME DELAY OPTION IS A8, THEN THIS IS PILOT TIME DELAY.

ITEC = INSTANTANEOUS TRIP ENABLE OUTPUT CONTACTS CLOSED.
S_E = INSTANTANEOUS TRIP SWITCH
INST. = INSTANTANEOUS RECLOSURE (NO INTENTIONAL DELAY).
TD_ = RECLOSURE TIME DELAY SETTING.
≈ = UNKNOWN TIME INTERVAL < RESET TIME SETTING.

BE1-79M
D741-008
6-19-91

Figure 3-5. Reclosing Sequences

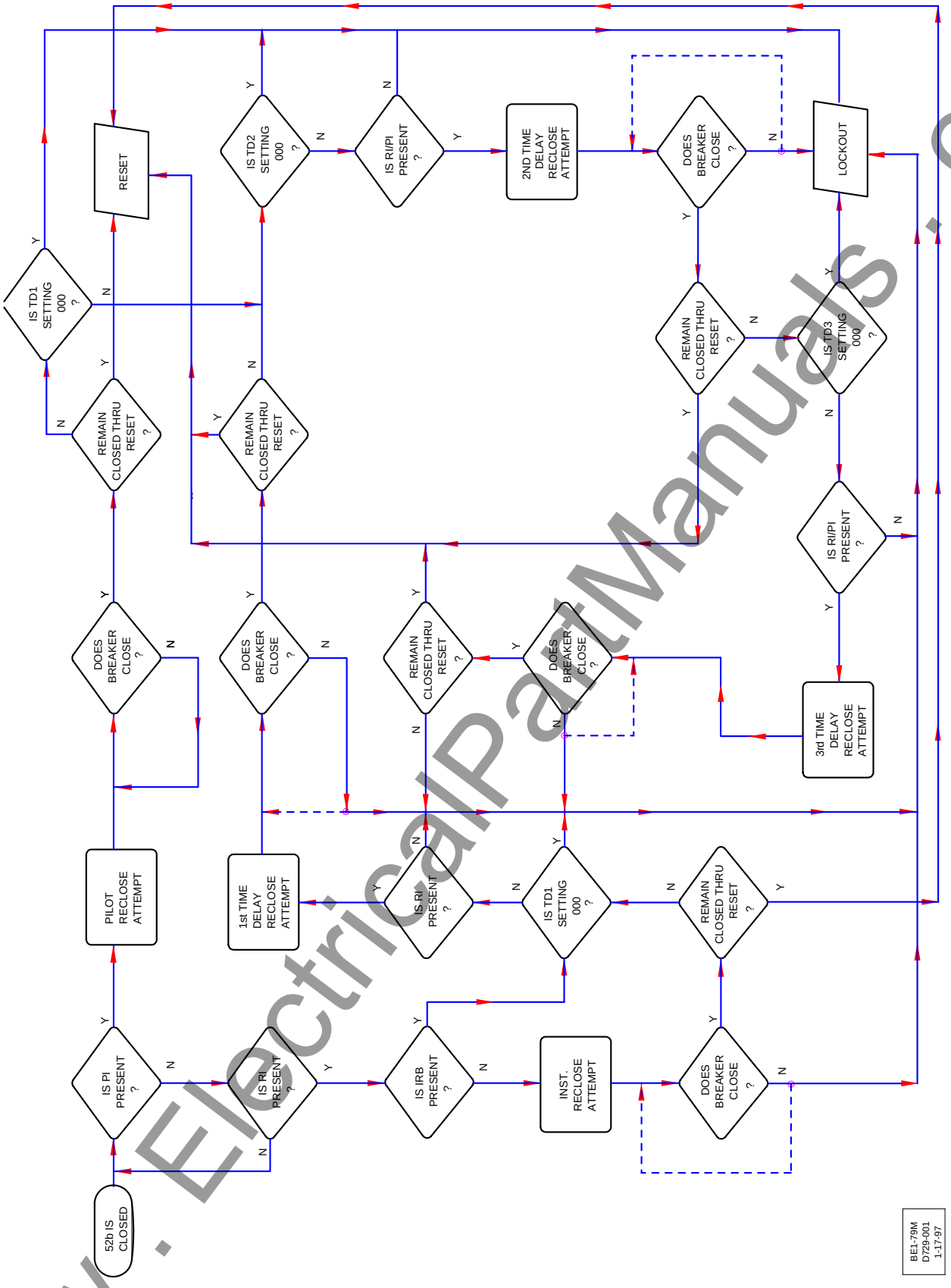


Figure 3-6. Reclosing Flow Chart

Control Outputs and Special Contact Assignments

Control output contacts and special contact assignments are options controlled by software. The functions of these contacts are as follows:

- I.T.E. Cold Load, Normally Open Option - The instantaneous trip enable output will remain open in the LOCKOUT condition. Thus, when a breaker is manually closed from LOCKOUT, the output will be open until the relay goes to reset. The normal I.T.E. option (NOT I.T.E. cold load) has the instantaneous trip enable output closed immediately after the breaker is manually closed.
- Pre-lockout Alarm Output, Normally Open Option - The pre-lockout alarm output will close immediately whenever the relay is attempting the last programmed reclose attempt. This output is mutually exclusive with the pilot reclose output. This output will remain closed until the relay reaches RESET.
- Reset Inhibit Input Option - A closed reset inhibit input inhibits the reset timer from timing and lights the RESET INHIBIT LED. When the input contact opens, the reset timer continues timing from the point of interruption and the RESET INHIBIT LED extinguishes. The reset inhibit input is mutually exclusive with the pilot initiate input, and the RESET INHIBIT LED is mutually exclusive with the PILOT LED.
- Reclose Wait Input Option - A closed reclose wait input inhibits all timers from timing. All output contacts remain in the previous state, unless the reclose or pilot outputs are energized prior to the input closing. If the reclose or pilot outputs are energized when reclose wait is closed, the outputs will open. When reclose wait input opens, reclosing will continue in the sequence to the next time delay or LOCKOUT. The reclose wait input replaces the reclose initiate input and RI is not required to initiate the reclosing sequence. Closing the 52b input initiates the reclosing sequence.
- Reclose Permissive Input Option - An open reclose permissive contact inhibits all front-panel-controlled delay timers and manual STATUS LED reset. The RESET LED flashes during this condition. An energized reclose or pilot output is de-energized when the reclose permissive contact opens. When the reclose permissive input contact closes, reclosing continues in the sequence to the next time delay or LOCKOUT.

A full reclose sequence (one instantaneous, followed by up to three time reclosures is enabled when the reclose permissive contact is closed and the 52b input contact is closed. The reclose initiate input is replaced by the reclose permissive input.

IRB and PI are latching inputs with this option. IRB and PI latch if closed when 52b input is closed and reclose permissive input contact is open. A reclose permissive input is required for a reclose sequence.

RECLOSING EVENT MEMORY

Purpose

In the normal service mode, the reclosing event memory (REM) increments software counters to record significant events of the reclosing sequence. When the relay is reset, the accumulated data is transferred to and stored in a nonvolatile memory. The data is retained even though power is lost. Only data accumulated prior to the last reset is retained in the non-volatile memory. If the relay loses power during a reclosing sequence, the data accumulated during this uncompleted sequence will not be saved.

The REM counts and stores the cumulative number of attempts made in the following categories.

- Instantaneous reclosures
- First time-delayed reclosures
- Second time-delayed reclosures
- Third time-delayed reclosures
- Pilot reclosures
- Unsuccessful reclosures

Maximum count is 999 attempts per event type. Drive-to-Lockout events are not counted. REM is not affected when the relay is in the test mode or by the position of the logic switch, S23, (reclose sequence memory save enable).

Data Retrieval

In order to retrieve data from REM, the relay must first be taken out of service and placed in the test mode. Do this by setting the logic board NORMAL/TEST switch (see Figure 2-1) to the TEST position. Then set the front panel RESET thumbwheel switch to 00. The relay is now ready for data retrieval. Before proceeding, notice that the following controls and indicators are re-defined whenever the REM function is in use.

RECLOSE TIME thumbwheel #3 (least significant digit only) - Selects the type of event for which data is to be retrieved. Refer to Table 3-4 for event and switch positions.

STATUS LEDs (INST., #1 and #2) - Verify that the digit selected on RECLOSE TIME thumbwheel #3 is correct. The STATUS LEDs will be ON as shown in Table 3-4.

RECLOSE TIME thumbwheel #1 (3 digits) - Indicates the number of accumulated events when manually rotated so that RESET LED and STATUS #3 LED are both ON.

STATUS LED #3 - Means "<" (less than).

RESET LED - Means ">" (greater than).

To retrieve REM data, complete the following procedure.

- Remove relay from service and position NORMAL/TEST switch to TEST.
- Position RESET thumbwheel switch to 00.
- Select the type of event (MODE) desired by setting RECLOSE TIME thumbwheel #3 as indicated in Table 3-4.
- Verify that the desired mode is selected by observing the INST., #1, and #2 STATUS LEDs.
- Observe the STATUS LED #3 and RESET LED. These indicators identify whether the number selected on RECLOSE TIME #1 thumbwheel is less (STATUS LED #3 ON) or greater (RESET LED ON) than the number stored in memory.
- Position RECLOSE TIME #1 thumbwheel until both STATUS LED and RESET LED are ON. When both indicators are ON, the selected number on RECLOSE TIME #l thumbwheel setting is equal to the stored number.

Table 3-4. REM Data Retrieval Modes

Type of Event	RECLOSE TIME #3 Thumbwheel (Least Significant Digit)	STATUS LED		
		INST	#1	#2
Instantaneous	0	0	0	0
1st time delayed	1	0	0	1
2nd time delayed	2	0	1	0
3rd time delayed	3	0	1	1
Pilot reclosure	4	1	0	0
Unsuccessful reclosures	5	1	0	1
None	Any other	1	1	1

NOTE: A "1" in the STATUS Indication column indicates LED is ON.

Data Retention

To retain data stored in memory and resume the event count,

- Position the NORMAL/TEST switch on the logic board to NORMAL.
- Return front panel controls to their regular settings.
- Place the relay back in service.

Clearing Stored Data

To clear the data from memory,

- Toggle the RESET lever once
- Position the NORMAL/TEST switch on the logic board to NORMAL.
- Return front panel controls to their regular settings.
- Place the relay back in service.

It is a good practice to verify that the memory is cleared by repeating the data retrieval procedure and observing the results.

This page intentionally left blank.

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 evidence of 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 operational test procedure (Section 5) 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 connection plugs and withdraw the cradle from its case.
2. When the connection 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.
3. Be sure the relay case is hard wired to earth ground using the ground terminal on the rear of the unit. It is recommended to use a separate ground lead to the ground bus for each relay.

DIELECTRIC TEST

In accordance with IEC 255-5 and ANSI/IEEE C37.90-1989, one-minute dielectric (high potential) tests up to 2500 Vac (45-65 Hz) may be performed except across open contacts, which may be tested up to 1500 Vac. Note that this device employs decoupling capacitors to ground from terminals 3, 4, 5, 6, 7, 8, 9, and 10. At 2500 Vac, a leakage current of approximately 5 mA per terminal is to be expected.

MOUNTING

Because the relay is of solid-state design, it does not have to be mounted vertically. Any convenient mounting angle may be chosen. Relay outline dimensions and panel drilling diagrams are shown in Figures 4-1 through 4-7.

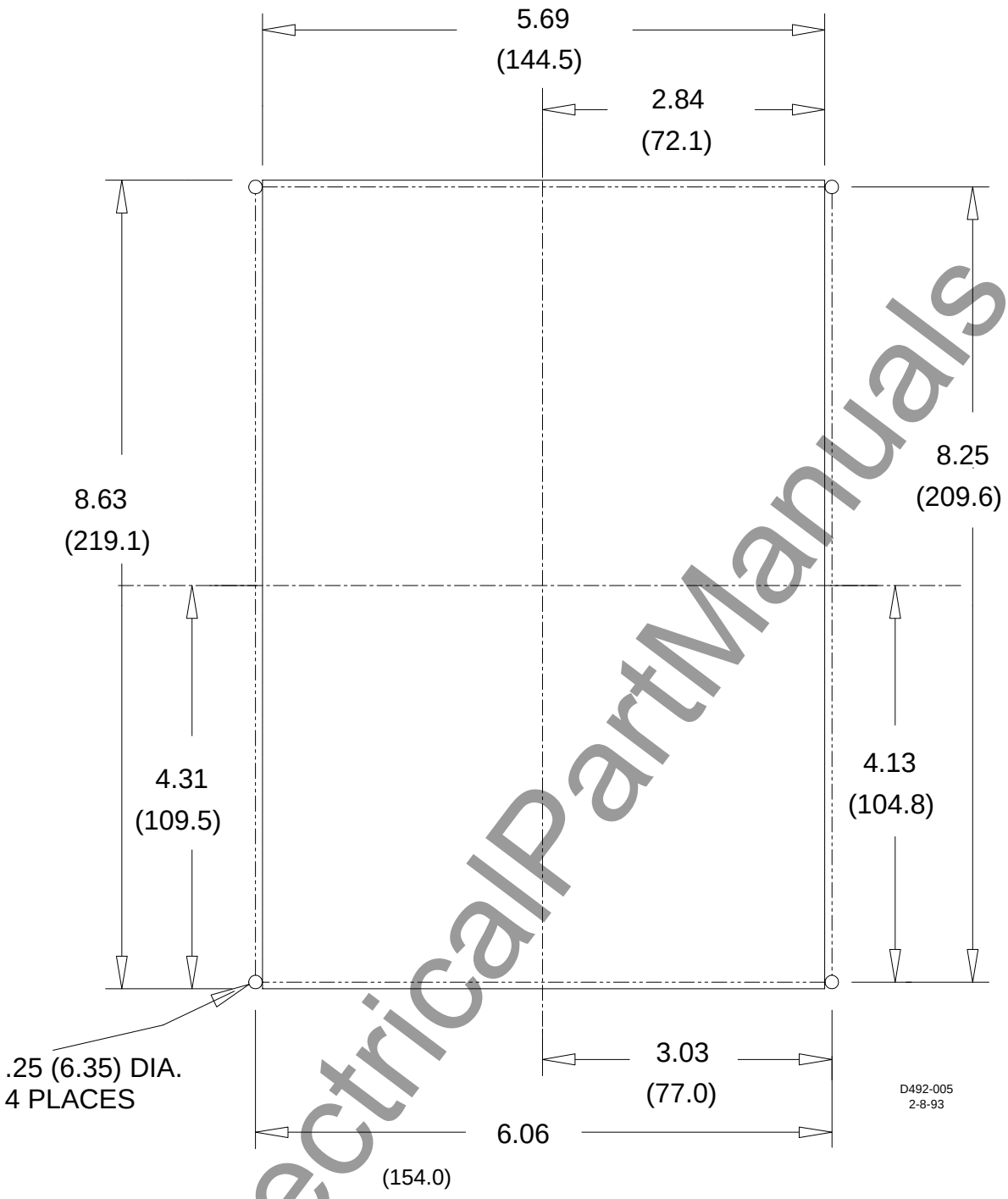
CONNECTIONS

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.

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, it is recommended to use a separate lead to the ground bus from each relay.

Connections should be made with minimum wire size of 14 AWG except as noted for the ground wire. Typical external connections are shown in Figures 4-8 through 4-10. Internal connections are shown in Figure 4-11.



MOUNT RELAY USING 4 #10 SCREWS

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

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

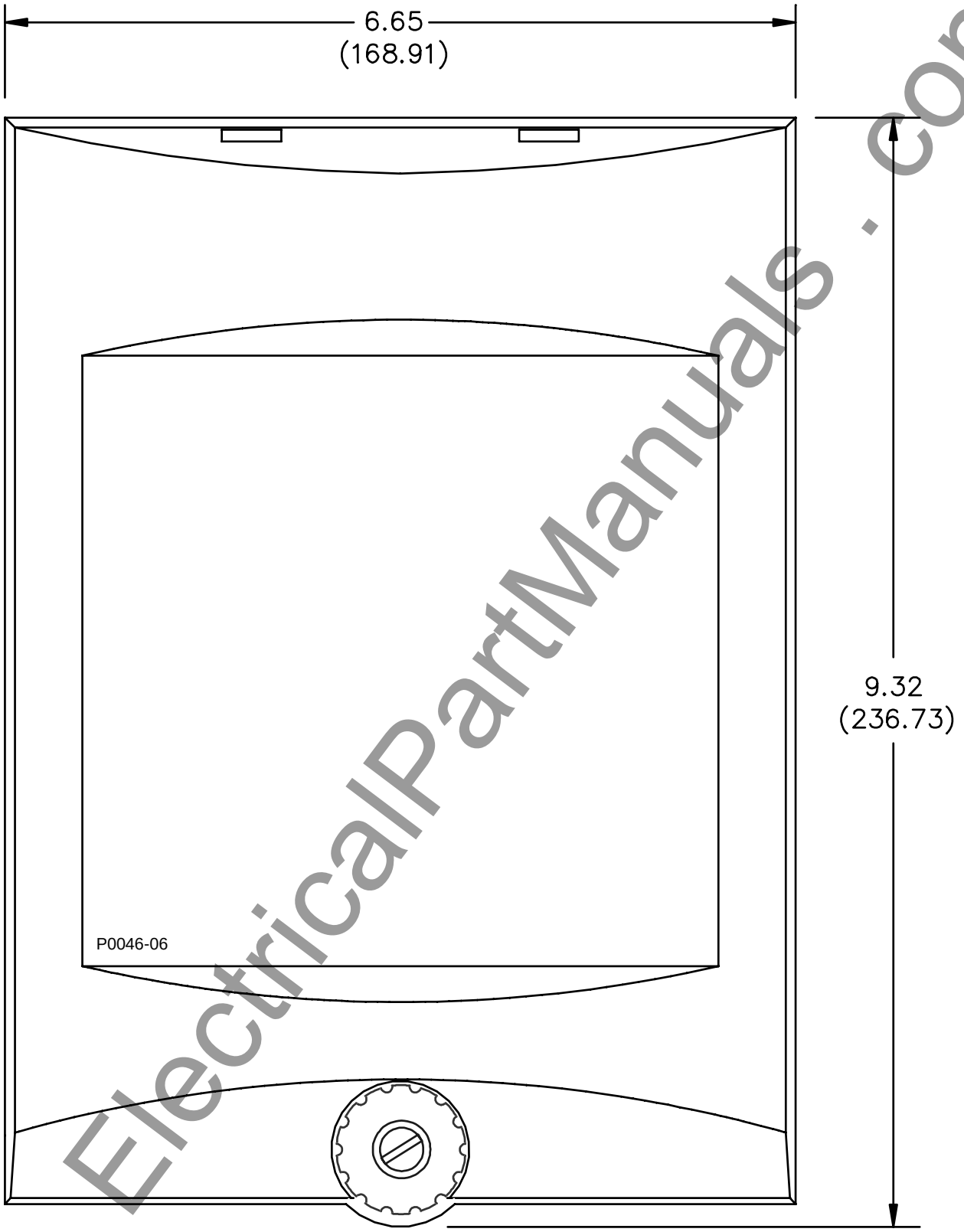


Figure 4-2. S1 Case, Outline Dimensions, Front View

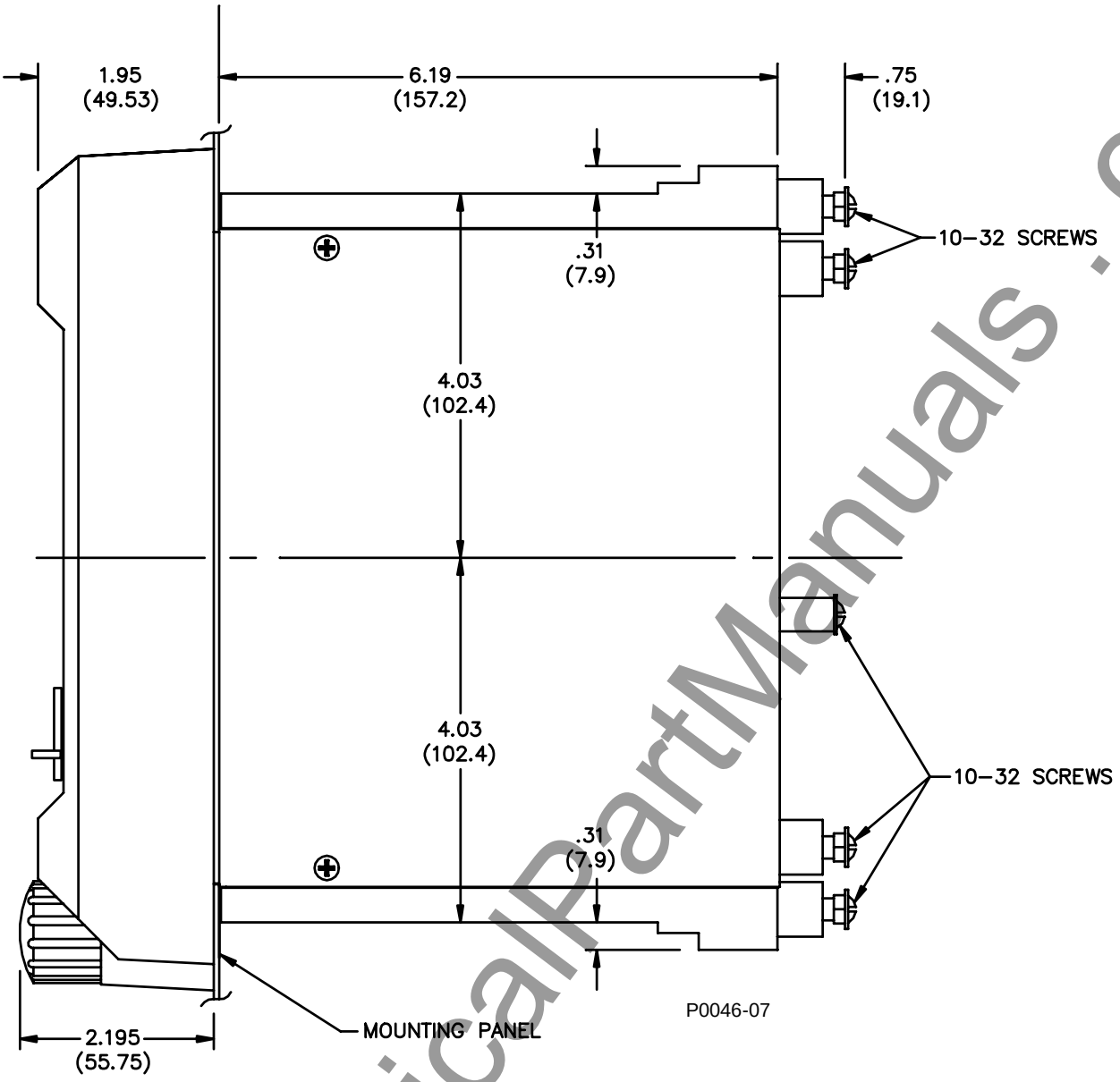


Figure 4-3. S1 Case, Double-Ended, Semi-Flush Mounting, Side View

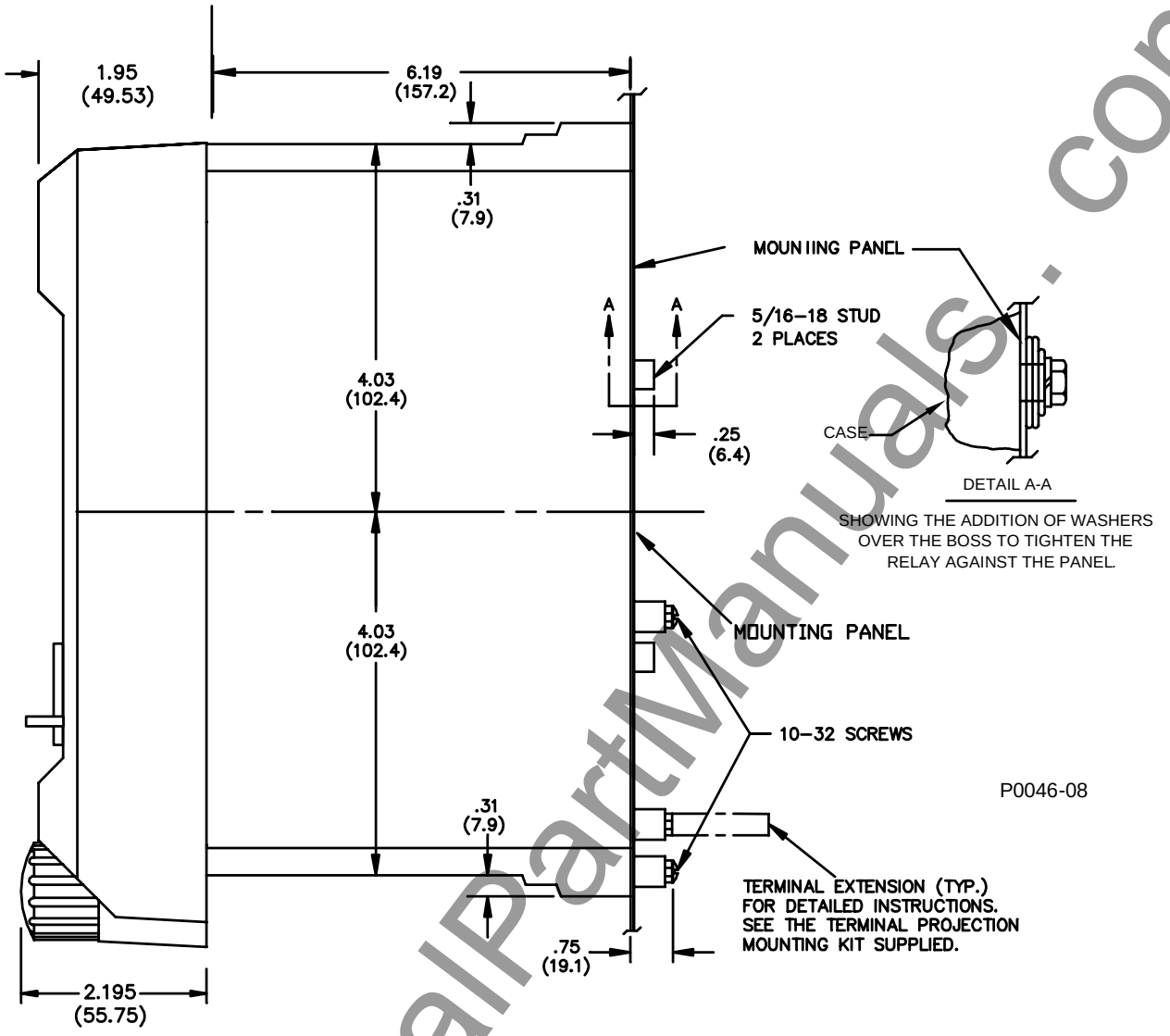
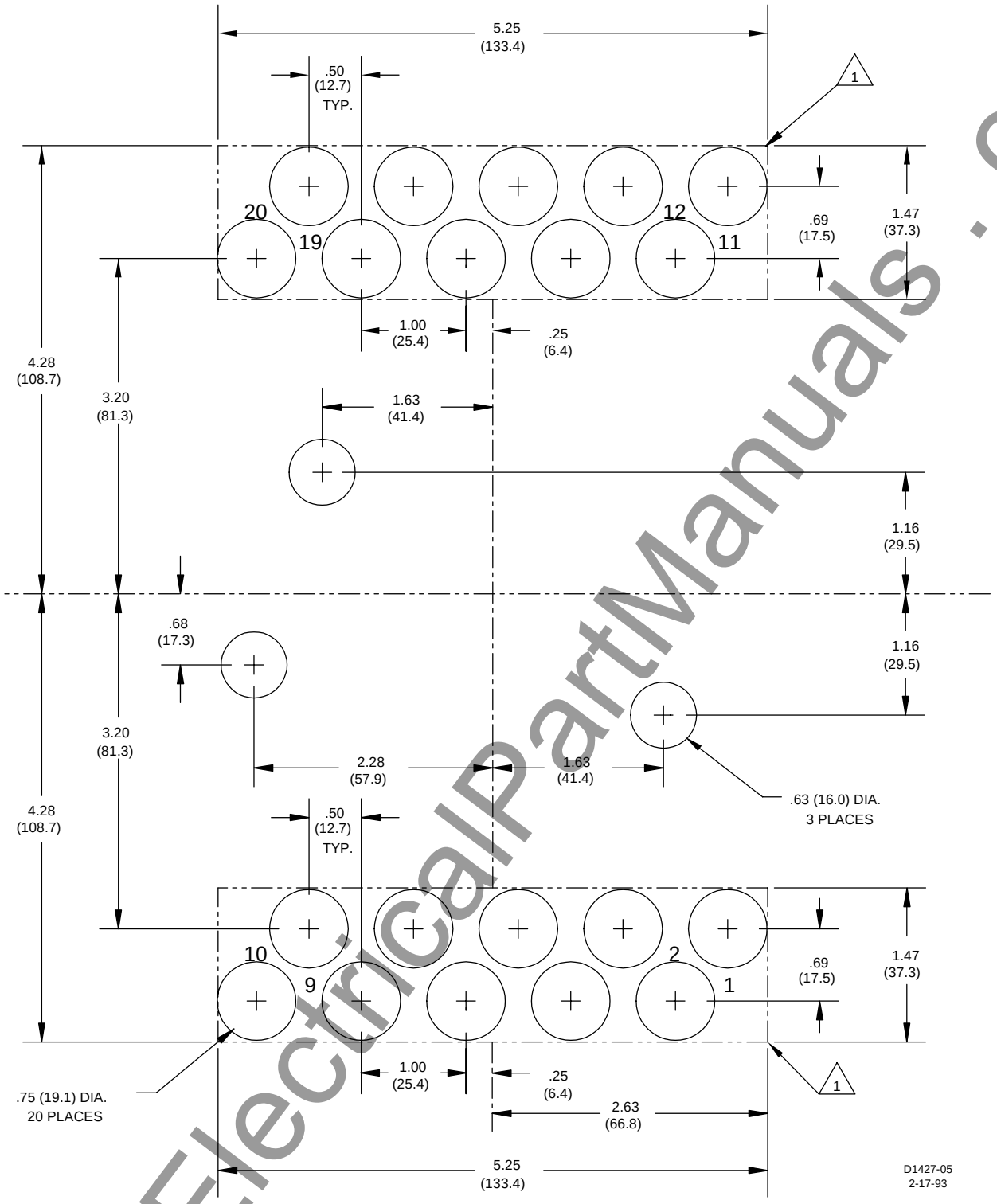


Figure 4-4. S1 Case, Double-Ended, Projection Mounting, Side View



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

Figure 4-5. S1 Case, Double-Ended, Projection Mounting, Panel Drilling Diagram, Rear View

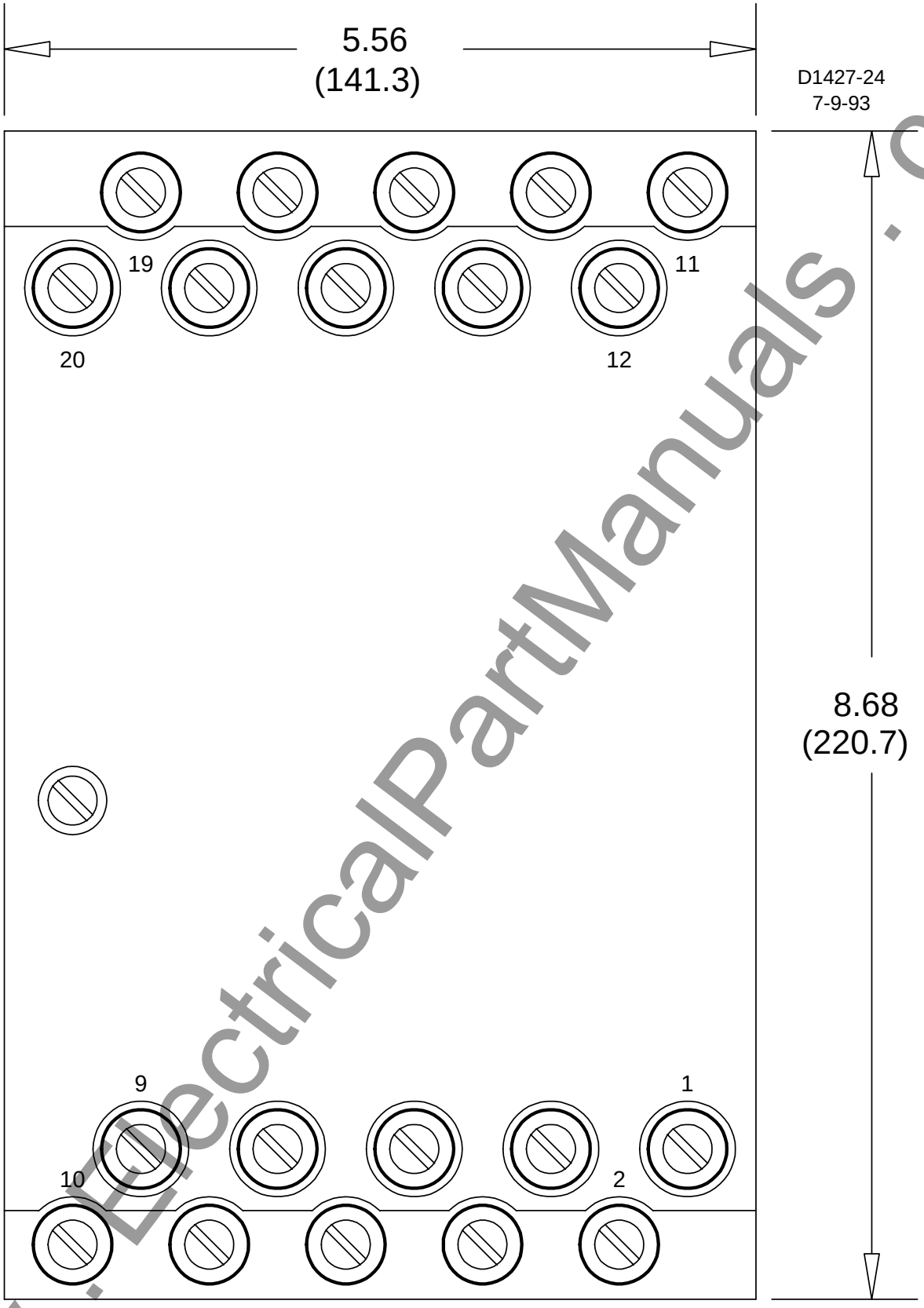


Figure 4-6. S1 Case, Double-Ended, Semi-Flush Mounting, Outline Dimensions, Rear View

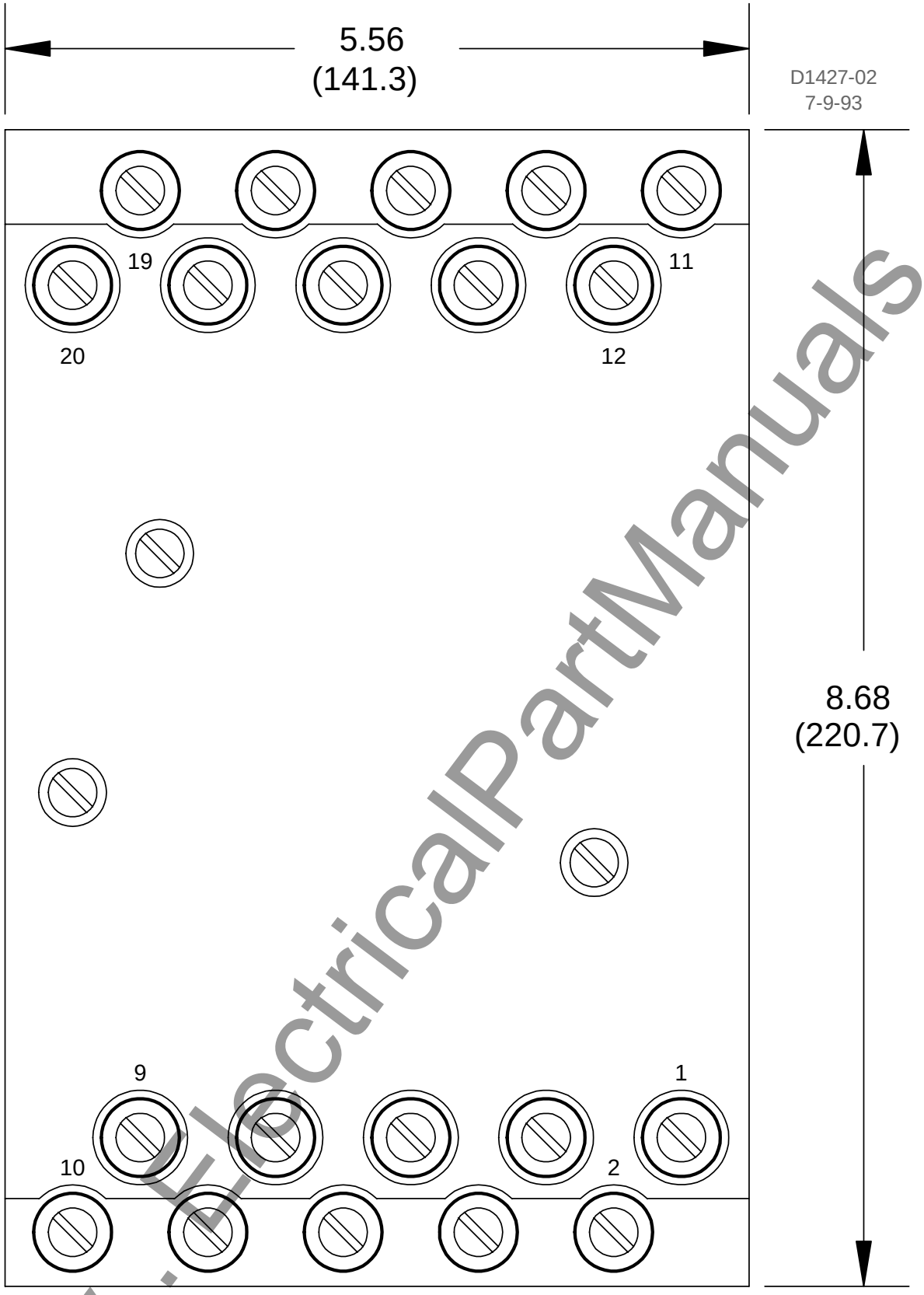
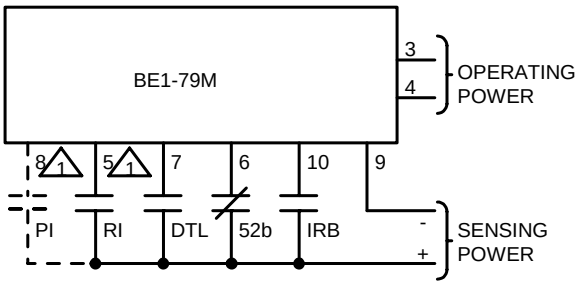
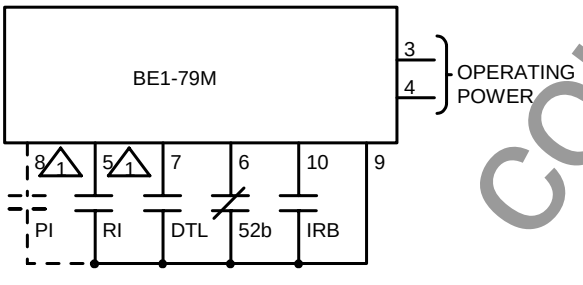


Figure 4-7. S1 Case, Double-Ended, Projection Mounting, Outline Dimensions, Rear View



NON-ISOLATED SENSING



ISOLATED SENSING

LEGEND:

RI RECLOSE INITIATE SENSING INPUT CONTACTS
DTL DRIVE-TO-LOCKOUT SENSING INPUT CONTACTS
52b CIRCUIT BREAKER SENSING INPUT CONTACTS
IRB INSTANTANEOUS RECLOSE BYPASS SENSING INPUT CONTACTS
PI PILOT INITIATE SENSING INPUT CONTACTS (OPTIONAL)
RST INH RESET INHIBIT SENSING INPYT CONTACTS (OPTIONAL)
REC WAIT RECLOSE WAIT SENSING INPUT CONTACTS (OPTIONAL)
RP RECLOSE PERMISSIVE SENSING INPUT CONTACTS (OPTIONAL)

1 IF OPTION 1 IS 1
PI IS REPLACED WITH RST INH.
IF OPTION 1 IS 2
RI IS REPLACED WITH REC WAIT.
IF OPTION 1 IS 4
RI IS REPLACED BY RP.

BE1-79M
D729-006
11-14-91

Figure 4-8. Sensing Input Connections

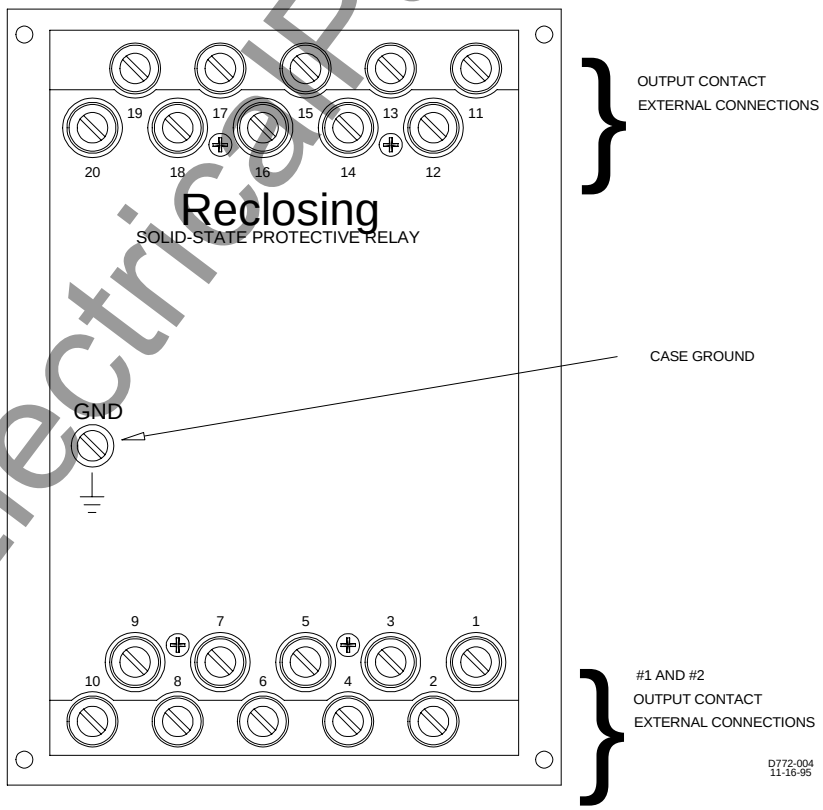
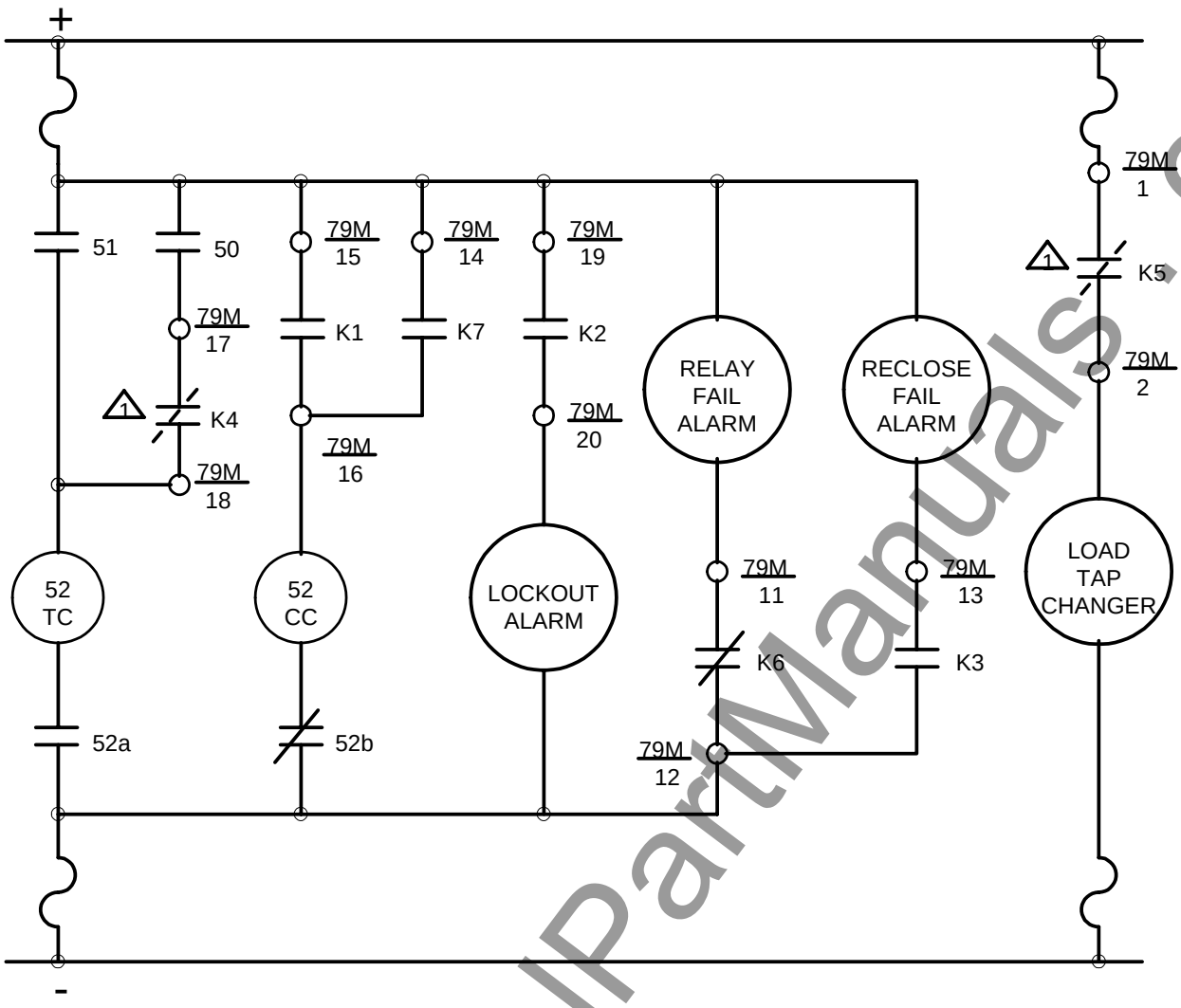


Figure 4-9. External Terminal Connections



LEGEND:

79M MULTIPLE SHOT RECLOSING RELAY
50 INSTANTANEOUS OVERCURRENT RELAY
51 TIME OVERCURRENT RELAY
52 CIRCUIT BREAKER
52a CIRCUIT BREAKER AUXILIARY CONTACTS
52b CIRCUIT BREAKER AUXILIARY CONTACTS
K1 RECLOSING OUTPUT CONTACTS
K2 LOCKOUT ALARM OUTPUT CONTACTS
K3 RECLOSE FAIL ALARM OUTPUT CONTACTS
(LOCKOUT AND RESET-2, 5, 6, 8)
K4 INSTANTANEOUS TRIP ENABLE OUTPUT CONTACTS
(CONTROL OUTPUT-A, C)
K5 BLOCK LOAD TAP CHANGER OUTPUT CONTACTS
(CONTROL OUTPUT-B, C)
K6 RELAY FAIL ALARM OUTPUT CONTACTS
K7 PILOT RECLOSING OUTPUT CONTACTS
(LOCKOUT AND RESET-3, 5, 7, 8)
TC TRIP COIL
CC CLOSING COIL
CONTROL CIRCUIT FUSING (IF USED)

1 MAY BE NO OR NC

BE1-79M
D729-007
5-13-91

Figure 4-10. Typical Output Connections

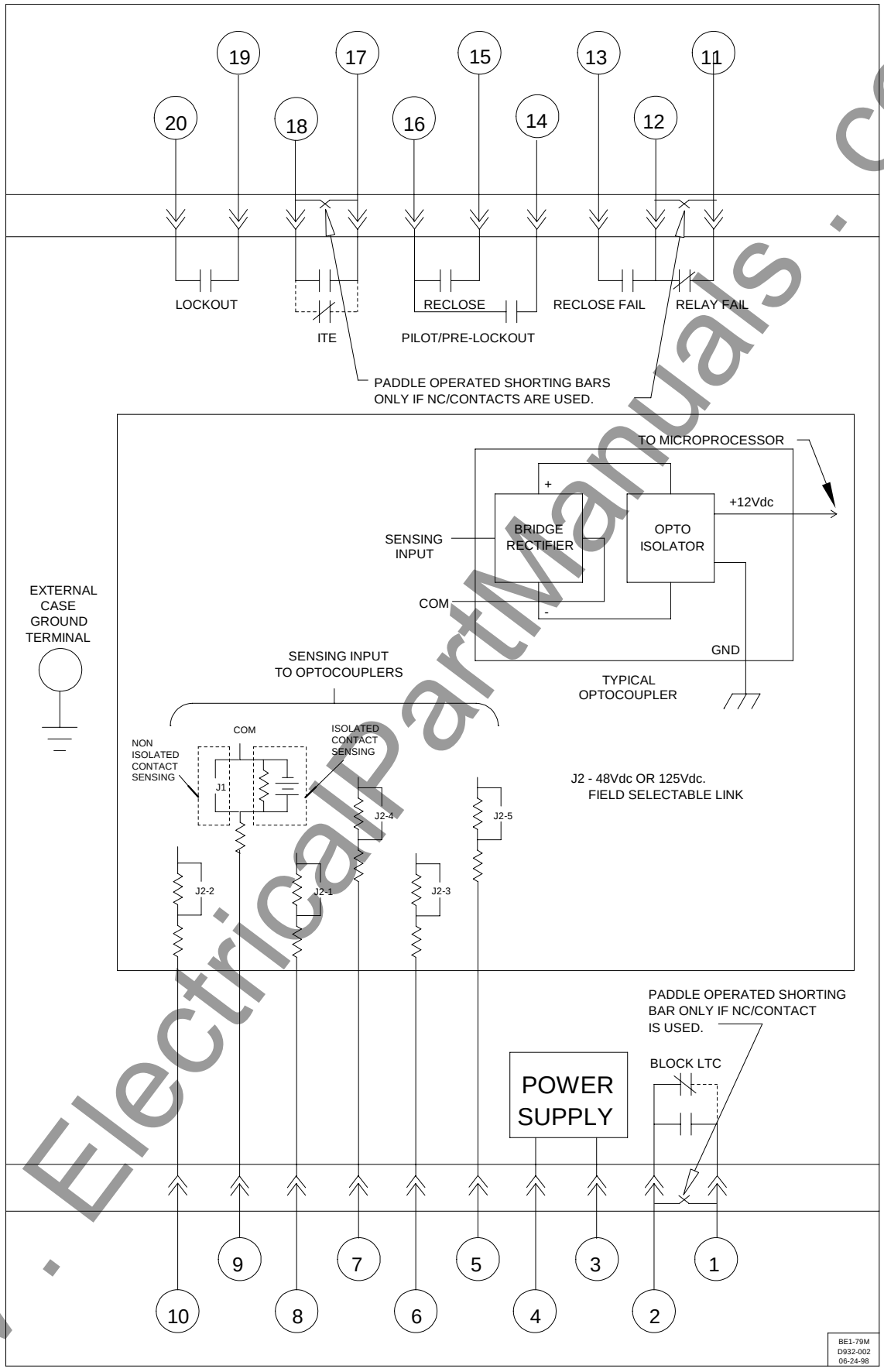


Figure 4-11. Typical Internal Connections

This page intentionally left blank.

SECTION 5 • TESTS AND ADJUSTMENTS

GENERAL

Procedures in this section are for use in testing and adjusting a relay for the desired operation in a protective scheme. If a relay fails an operational test, or if an adjustment discloses a faulty relay, refer to Section 6.

REQUIRED TEST EQUIPMENT

Minimum test equipment required for relay testing and adjustment is listed below. Refer to figure 5-1 for the test setup.

NOTE

Commercially available frequency relay test sets with frequency and time generating accuracies exceeding those of the relay, and including electronic switching, may be used.

a. Appropriate ac or dc power source for relay operation.

b. Appropriate ac source for frequency sensing. (A source with frequency stability of 0.00002 Hz must exhibit phase noise of less than 90 db for accurate measurement. The accuracy and stability of this source is necessary as the relay precisely measures the period between positive going zero-crossings of the applied waveform and responds instantaneously to the sensed condition.)

c. Hardware (battery, and lamp, multimeter, etc.) or method of determining that the output contacts close.

OPERATIONAL TEST

The following procedure verifies operation of the relay.

CAUTION

Performing the Operational Test Procedure with the relay in the NORMAL Mode will increment the reclosing event memory. Prior to initiating the Operational Test Procedure, record the contents of the reclosing event memory.

Care must be taken not to exceed output contact ratings.

STEP 1. Connect the circuit as shown in Figure 5-1. K1 is a latching relay with a set of Form B auxiliary contacts to simulate a controlled breaker. If the Pilot Initiate option is not present, S4 and the connections to terminals 8 and 14 are not needed.

STEP 2. Press and release switch S7 (K1 reset) to assure that K1-auxiliary contacts are open (breaker closed). Set thumbwheel switches as indicated below.

RESET (Note 1)	60.0 seconds	(06 setting)
RECLOSE TIME (Note 2 and Note 3)		
1	05.0 seconds	(050 setting)
2	10.0 seconds	(100 setting)
3	15.0 seconds	(150 setting)
RECLOSE FAIL	Inhibited	(00 setting)
MAX. Cycle	1000.0 seconds	(000 setting)

NOTES:

1. If reset timer option is D, set RESET to 60.
2. If reclose time delay option is A7, set RECLOSE TIME 2 to 010 and RECLOSE TIME 3 to 015.
3. If reclose time delay option is A8, set PILOT TIME to 99.

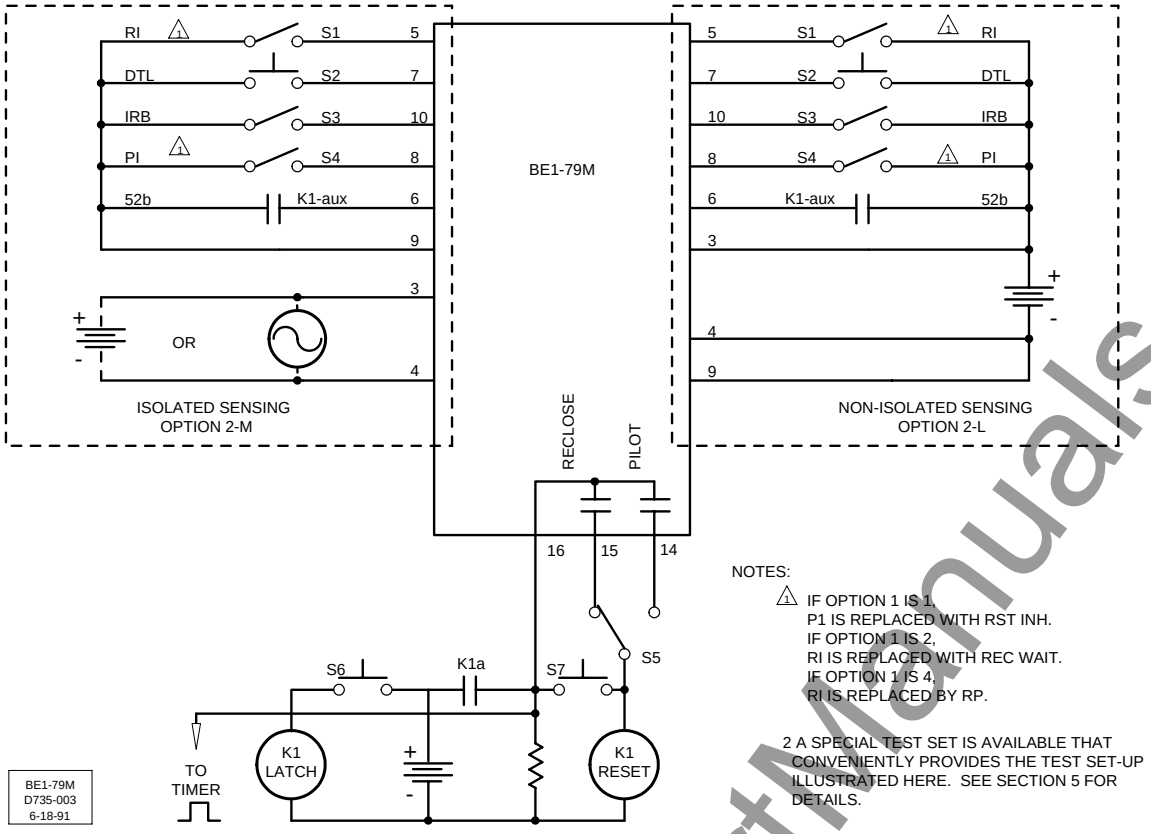


Figure 5-1. Operational Test Setup

STEP 3. If Instantaneous Trip Enable option is present in your unit, place all INSTANTANEOUS TRIP toggle switches in the Block position. Apply relay operating power. POWER LED and RELAY FAIL LED should light. In 60 seconds, RELAY FAIL LED should go out and RESET LED should light. If the BLTC option is present, a continuity check should show continuity between terminals 1 and 2. If BLTC NO option is present, a continuity check should **NOT** show continuity between terminals 1 and 2.

STEP 4. Set test timer to zero. Close RI switch (S1). If option 1 is 2 (Reclose Wait) do **NOT** close RI. Place switch S5 to the RECLOSE position (terminal 15). Press and quickly release switch S6 (K1 latch) to simulate breaker opening. The OUTPUT ENERGIZE LED should light briefly. The INST. STATUS LED should light and stay lit. Timer should indicate 50 milliseconds or less. The RESET LED should light in 60 seconds.

STEP 5. Toggling the front panel RESET lever should extinguish the INST. STATUS LED.

STEP 6. Close switch S3 (IRB). Reset the timer. Press and release switch S6 (K1 latch) to simulate breaker opening. After a short interval, the OUTPUT ENERGIZE LED should light briefly and the STATUS 1 LED should light. Timer should indicate 5 ±0.05 seconds. If the BLTC NC option is present, a continuity check should **NOT** show continuity between terminals 1 and 2. If BLTC NO option is present, a continuity check should show continuity between terminals 1 and 2.

STEP 7. Reset the timer. Press and release switch S6 (K1 latch) to simulate breaker opening. After a short interval, the OUTPUT ENERGIZE LED should light briefly and the STATUS 2 LED should light. Timer should indicate 10 ±0.1 seconds.

STEP 8. Reset the timer. Press and release switch S6 (K1 latch). After a short interval, the OUTPUT ENERGIZE LED should light briefly and the STATUS 3 LED should light. Timer should indicate 15 ±0.15 seconds.

STEP 9. Press and release switch S6 (K1 latch) to simulate breaker opening. LOCKOUT LED should light immediately. If the BLTC NC option is present, a continuity check should show continuity between terminals 1 and 2. If the BLTC NO option is present, a continuity check should **NOT** indicate continuity between terminals 1 and 2.

STEP 10. Press and release switch S7 (K1 reset) to simulate breaker closed. Reset the timer. In 60 seconds, the LOCKOUT LED should go out and the RESET LED should light. Toggling the front panel RESET lever should extinguish the STATUS 1, 2, and 3 LEDs. If automatic reset of STATUS LEDs is selected on logic switch S23, the STATUS 1, 2, and 3 LEDs will extinguish when the relay reaches RESET.

STEP 11. Press and release switch S2 (DTL). The RESET LED should go out and the LOCKOUT LED should light. A continuity check across terminals 19 and 20 should indicate continuity. In approximately 60 seconds, the LOCKOUT LED should go out and the RESET LED should light. Open switch S3 (IRB).

STEP 12. Change RECLOSE TIME 1 thumbwheel setting to 000. Press and release switch S6 (K1 latch). The RESET LED should go out and the INST. LED should light. Press and release S6 again. The LOCKOUT LED should light. A continuity check across terminals 19 and 20 should indicate continuity. Press and release switch S7 (K1 reset). In 60 seconds, the LOCKOUT LED should go out and the RESET LED should light. Toggling the front panel RESET lever should extinguish the INST. LED. If automatic reset of STATUS LEDs is selected on logic switch S23, the STATUS INST. LED will extinguish when the relay reaches RESET. Change RECLOSE TIME 1 thumbwheel setting to 050.

NOTE

Steps 13 and 14 apply only to units with the Pilot Initiate option. (Lockout and Reset 3, 5, 7, or 8.)

STEP 13. Reset the timer. Open switch S1 (RI). If option 1 is 4 (Reclose Permissive) do **NOT** open S1. Close switch S4 (PI). Place switch S5 to the PILOT position (terminal 14). Press and release switch S6 (K1 latch). The PILOT LED should light. The timer should indicate 50 milliseconds or less. If reclose time delay option is A8, PILOT TIME delay will be 0.99 ±0.005 seconds.

STEP 14. Before the relay reaches RESET, reset the timer. Place switch S5 to the RECLOSE position (terminal 15). Press and release switch S6 (K1 latch). After 10 seconds, the OUTPUT ENERGIZE LED should light briefly and the STATUS 2 LED should light. The timer should indicate 10 ±.10 seconds. In 60 seconds the RESET LED should light. Toggling the front panel RESET lever should extinguish the STATUS 2 and PILOT LEDs. If automatic reset of STATUS LEDs is selected on logic switch S23, the STATUS 2 and PILOT LEDs will extinguish when the relay reaches RESET. Open switch S4 (PI). Close switch S1 (RI). If option 1 is 2 (Reclose Wait) do **NOT** close S1.

NOTE

Steps 15 through 17 apply only to units with the Instantaneous Trip Enable option. (Control Outputs A, C, D, E, F, G, H, or I.)

STEP 15. Set RECLOSE TIME 1, 2, and 3 thumbwheel switches to 010. (If reclose time delay option is A7, set RECLOSE TIME 2 and 3 to 001). Verify that the RESET LED is lit. Simultaneously place all INSTANTANEOUS TRIP toggle switches in the ENABLE position. Verify that switch S23 (IRB) is still open (reference step 11).

NOTE

Step 16 should be performed in less than 60 seconds to prevent the relay from going into RESET.

STEP 16. Prepare for continuous continuity testing between terminals 17 and 18. Initial test should indicate continuity if I.T.E. NO option is selected. If I.T.E. NC option is selected, all continuity indications will be the opposite of that described for this step.

a. Press and release S6. The INST. LED should light, and there should be continuity between terminals 17 and 18.

b. Press and release S6. In 1 second, the STATUS 1 LED should light, and there should be continuity between terminals 17 and 18.

c. Press and release S6. In 1 second, the STATUS 2 LED should light, and there should be continuity between terminals 17 and 18.

d. Press and release S6. In 1 second, the STATUS 3 LED should light and continuity between terminals 17 and 18 should exist.

e. Press and release S6. The LOCKOUT LED should light.

f. Press and release S7. There should be continuity between terminals 17 and 18. If Control Output option is F or G (I.T.E. Cold Load), terminals 17 and 18 will **NOT** have continuity.

Disconnect continuity tester.

STEP 17. In 60 seconds, the RESET LED should light and the LOCKOUT LED should extinguish. Toggling the front panel RESET lever should extinguish the STATUS 1, 2, 3, and INST. LEDs. If automatic reset of STATUS LEDs is selected, the STATUS 1, 2, 3, and INST. LEDs will extinguish when the relay reaches RESET. Place all INSTANTANEOUS TRIP switches into the BLOCK position.

NOTE

Step 18 applies only to units with the Reclose Failure options (i.e., - Lockout and Reset options 2, 5, 6, or 8).

STEP 18. Disconnect the test circuit from terminal 16. Set RECLOSE FAIL thumbwheel setting to 50 (i.e., 5.0 seconds). Press and release switch S6 (K1 latch). The INST. and OUTPUT ENERGIZE LEDs should light. In approximately 5 seconds, the OUTPUT ENERGIZE LED should go out and the RECLOSE FAIL and LOCKOUT LEDs should light. Check for continuity between terminals 12 and 13. Press and release switch S7 (K1 reset). Wait for RESET LED to light. Toggling the front panel RESET lever should extinguish the INST. LED. If automatic reset of STATUS LEDs is selected on logic switch S23, the STATUS INST. LED will extinguish when the relay reaches RESET. Reconnect the test circuit to terminal 16.

NOTE

Step 19 applies only to units with the Maximum Cycle options (i.e., - Lockout and Reset options 4, 6, 7, or 8).

STEP 19. Set MAX. CYCLE thumbwheel setting to 020. If present, set RECLOSE FAIL thumbwheel setting to 00. Press and release switch S6 (K1 latch). The INST. and OUTPUT ENERGIZE LEDs should light. In approximately 20 seconds, the MAX. CYCLE and LOCKOUT LEDs should light. Press and release switch S7 (K1 reset) and wait for RESET LED to light. Toggling the front panel RESET lever should extinguish the INST. LED. If automatic reset of STATUS LEDs is selected on logic switch S23, INST. LED will extinguish when the relay reaches RESET. Reconnect the test circuit to terminal 16.

NOTE

Steps 20 through 23 apply only to units with option 1, special contact assignment 3 (Pre-lockout).

STEP 20. Close RI and IRB input switches.

STEP 21. Press and release S7 (K1 reset) and allow reclose time delay to expire.

STEP 22. After the breaker recloses and before reset time delay expires, press and release S6 (K1 latch), and allow time delay to expire.

STEP 23. Monitor terminals 14 and 16 for continuity. Repeat Step 22 until the last programmed reclose occurs. When the last programmed reclose occurs, terminals 14 and 16 should have continuity.

NOTE

Step 24 applies only to units with option 1, special contact assignment 1 (Reset Inhibit).

STEP 24. Repeat Steps 20 and 21, but close the Reset Inhibit input (PI) before the reset time delay expires. Verify RESET INHIBIT LED lights when reset inhibit input is closed. After 60 seconds, verify relay is **NOT** RESET.

STEP 25. Open Reset Inhibit input and verify relay advances to reset after the remaining time expires (from the point reset was interrupted in Step 24), and RESET INHIBIT LED extinguishes.

NOTE

Step 26 applies only to units with option 1, special contact assignment 2 (Reclose Wait).

STEP 26. Initially leave Reclose Wait input (RI) open. Repeat Steps 20 through 22, but close the Reclose Wait (RI) input while reclose time delay is timing.

STEP 27. Verify that after five seconds expires, no reclose occurs.

STEP 28. Open Reclose Wait input and verify relay recloses after the remaining time expires (from the point reclose was interrupted in Step 26.)

NOTE

Step 29 applies only to units with option 1, special contact assignment 4 (Reclose Permissive).

STEP 29. Repeat Steps 20 and 21, but before reclose time delay expires, open the Reclose Permissive (RI) input.

STEP 30. Verify that RESET LED flashes and no reclose occurs after reclose time delay expires.

STEP 31. Close Reclose Permissive (RI) input and verify relay recloses after the remaining time expires (from the point reclose was interrupted in Step 29.)

CAUTION

Performing the Operational Test Procedure has incremented the reclosing event memory. Record the contents of the reclosing event memory or clear the memory entirely before placing the relay into normal service operation.

This concludes the operational test procedure.

RECLOSING EVENT MEMORY (REM)

Data Retrieval

The following procedure is an example of retrieving data from the Reclosing Event Memory.

STEP 1. Remove the relay from service.

STEP 2. Position the NORMAL/TEST switch (on logic board) to TEST.

STEP 3. Position RESET thumbwheels to 00.

STEP 4. Adjust RECLOSE TIME 3 LSD thumbwheel to the desired type of event data to be retrieved. (Refer to Table 3-4).

STEP 5. Verify that the appropriate STATUS LEDs light. The correlation between the STATUS LEDs and the RECLOSE TIME 3 (LSD) verify proper memory addressing.

STEP 6. Position RECLOSE TIME 1 thumbwheels to 000.

STEP 7. Observe STATUS 3 LED and RESET LED. These two LEDs guide the operator as to whether the RECLOSE TIME 1 thumbwheel number is less than or greater than the actual number of events stored in memory.

STEP 8. Begin with MSD of RECLOSE TIME l and increase setting until RESET LED lights, and STATUS LED goes out. Setting is now greater than event count in memory. Decrease setting one number.

STEP 9. Increase the setting on RECLOSE TIME 1, 2nd MSD, until RESET LED lights, and then decrease the setting one number.

STEP 10. Increase the setting on RECLOSE TIME 1, LSD, until the STATUS LED 3 and RESET LED light. The number shown on RECLOSE TIME 1 setting equals the number of events recorded.

Data Retention

To retain the data that is stored in memory and resume the event count, proceed as follows:

STEP 1. Position the NORMAL/TEST switch (on the logic board) to NORMAL.

STEP 2. Return all front panel controls to their normal service positions.

STEP 3. Return relay to service. Relay will resume normal operation and the event count from that point.

Clearing Stored Data

To clear the old data from memory before returning the relay to normal service, proceed as follows:

STEP 1. Toggle RESET lever once. This action clears memory. Memory clear can be verified by keeping RECLOSE TIME l at 000, and by rotating the LSD of RECLOSE TIME 3 from 0 through 5. The STATUS 3 and RESET LEDs should light at each setting.

STEP 2. Position the NORMAL/TEST switch (on the logic board) to NORMAL.

STEP 3. Return all front panel controls to their normal service position.

STEP 4. Return the relay to service. The relay will resume normal operation and begin a new count of events.

SECTION 6 • MAINTENANCE

GENERAL

BE1-79M Multiple Shot Reclosing Relay requires no preventive maintenance other than a periodic operational test (refer to Section 5 for operational test procedure). If factory repair is desired, contact the Customer Service Department of the Power Systems Group, Basler Electric, for a return authorization number prior to shipping.

IN-HOUSE REPAIR

In-house replacement of individual components may be difficult and should not be attempted unless appropriate equipment and qualified personnel are available.

CAUTION

Substitution of printed circuit boards or individual components does not necessarily mean the relay will operate properly. Always test the relay before placing it in operation.

Replacement parts may be purchased locally. The quality of replacement parts must be at least equal to that of the original components.

Where special components are involved, Basler Electric part numbers may be obtained from the number stamped on the component or assembly, the schematic, or parts list. These parts may be ordered directly from Basler Electric. When complete boards or assemblies are needed, the following information is required.

1. Relay model and style number
2. Relay serial number
3. Board or assembly
   a) Part number
   b) Serial number
   c) Revision letter
4. The name of the board or assembly.

STORAGE

This protective relay contains aluminum electrolytic capacitors, which generally have a 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 one-year intervals, power is applied to the relay for a period of thirty minutes.

TEST PLUG

Test plug (Basler P/N 10095) provides a quick, easy method of testing relays without removing them from the case. The test plug is simply substituted for the connection plug. This provides access to the external stud connections as well as to the internal circuitry.

The test plug consists of a black and red phenolic molding with twenty electrically separated contact fingers connected to ten coaxial binding posts. The ten fingers on the black side are connected to the inner binding posts (black thumbnuts) and tap into the relay internal circuitry. The ten fingers on the red side of the test plug are connected to the outer binding posts (red thumbnuts) and to the relay case terminals.

When testing circuits connected to the bottom set of case terminals, the test plug is inserted with the numbers 1 through 10 facing up. When using the test plug in the upper part of the relay, the numbers 11 through 20 are face up. It is impossible, due to the construction of the test plug, to insert it with the wrong orientation.

BE1-79M TEST SET

General

CAUTION

Before powering Test Set or relay, verify that NON-ISOL/ISOL switch is in the correct position. NON-ISOL for relays with option 2-L, and ISOL for relays with option 2-M. Damage to the relay will occur if the switch is in the wrong position.

The BE1-79M Test Set (Figure 6-1) contains circuitry that simulates a breaker to simplify the testing of reclosing relays. This device is available through Basler Electric and its field representatives. Order by part number 9 1701 14 100.

Switches RI, PI, IRB, DTL, and SYNC are OPEN in the down position and CLOSED in the up position. The purpose of the various switches and lamps of the Test Set is self-evident except as follows.

SYNC Switch

Test set SYNC switch is in series with the relay reclose output contacts. With the SYNC switch in the open (down) position, only the Pilot reclose output contacts can simulate a breaker closure. The switch provides a way to determine which output (Pilot or Reclose) is causing simulated breaker closure.

52a Lamp (Red)

When the red lamp is ON, it confirms that the 52a contact is closed and that the simulated breaker is closed.

52b Lamp (Green)

When the green lamp is ON, it confirms that the 52b contact is closed and that the simulated breaker is open.

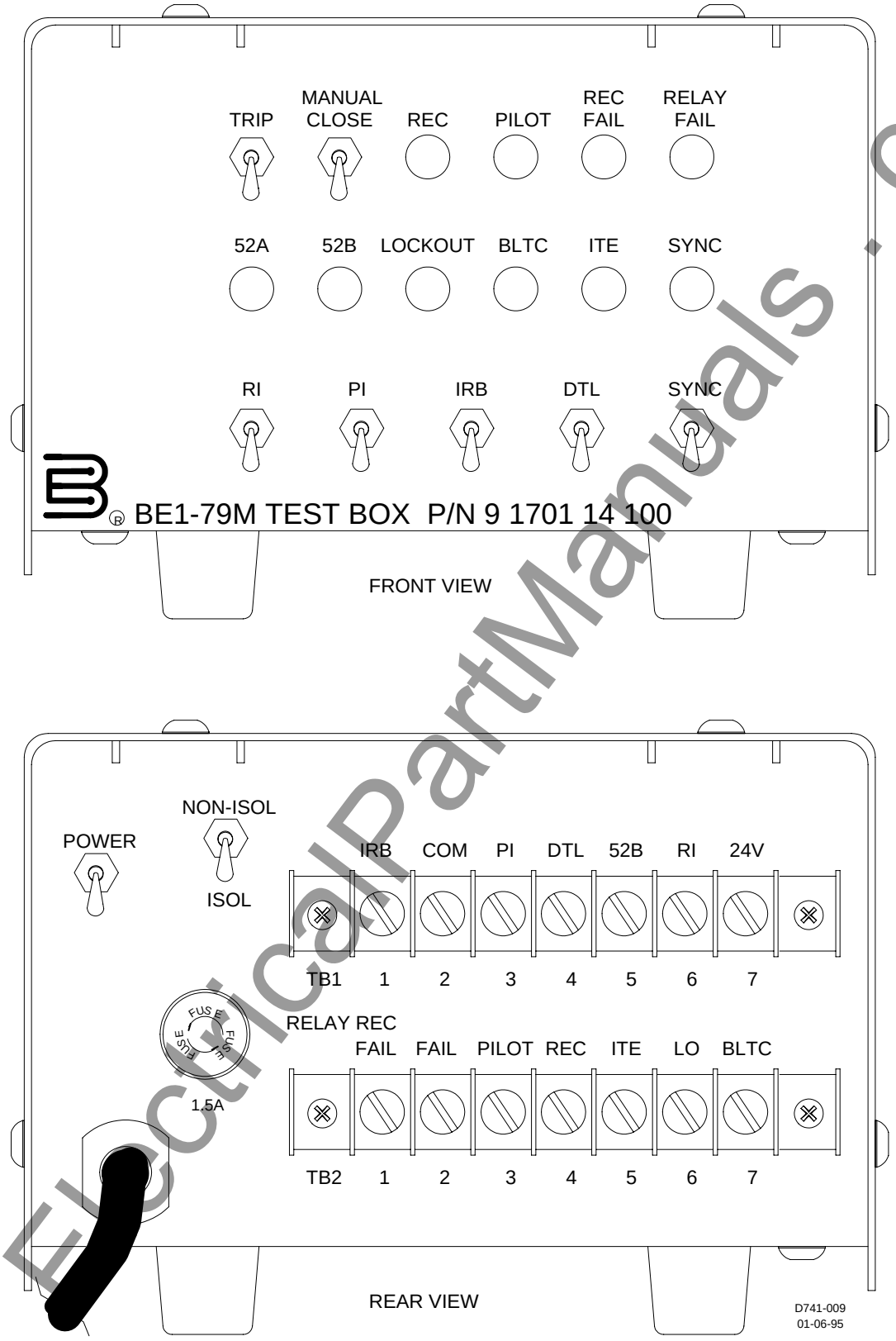


Figure 6-1. BE1-79M Test Set

This page intentionally left blank.

SECTION 7 • DIFFERENCE DATA

GENERAL

This section provides the information necessary to support BE1-79M Multiple Shot Reclosing Relays, Revision D and previous.

DIFFERENCES

BE1-79M Multiple Shot Reclosing Relay, Revision F added the following features and capabilities.

- Six additional control output options
- Two additional reclose time delay options
- Y-type power supply option
- Reset timer 1-100 second time delay option
- Four additional special contact assignment options
- A four function, 16 position, field selectable logic switch
- Moved sensing input power module from outside the case to inside the case

The following style number identification chart is applicable to relays, revision D and previous, and will identify those relay features and capabilities. Disregard information contained in Sections 2 through 6 of this instruction manual that are peculiar to relays, revision F and subsequent. For installation, testing, and maintenance of revision D and previous relays, the following information is necessary.

COMPATIBILITY

Revision E and subsequent are backward compatible with revision D and previous with one exception. This exception is a relay with a type Z power supply (250 Vdc/230 Vac) and isolated sensing. To use a relay revision E or subsequent in a revision D or previous relay installation (case), the external sensing module (part number 9170206101 or part number 9170206102) must be removed from the wiring scheme and connected for isolated sensing as shown in Figure 4-8. All other revision E and subsequent relays may be installed into existing installations (cases) without rewiring.

CONNECTIONS

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, it is recommended to use a separate lead to the ground bus from each relay.

External connections for the contact sensing inputs are made at the power module on the rear of the relay case (Figure 8-1). External connections for the output contacts are made at the relay case terminals. If a type Z power supply has been selected, external connections for the contact sensing inputs are made at the sensing input module located external to the relay. The sensing input module may be located remotely from the relay. Typical sensing input module connections wired to the remote power module are shown in Figure 8-2. Connections should be made using a minimum wire size of 14 AWG stranded wire except as noted for the ground wire.

STYLE NUMBER IDENTIFICATION CHART

BE1-79M B [ ] [ ] — [ ] [ ] [ ] — [ ] [ ] [ ] 0 [ ]

MODEL NO.

SENSING INPUT TYPE
B) Multi-shot

LOCKOUT & RESET
1) Lockout and Reset
2) Lockout and Reset with Reclose Failure Alarm
3) Lockout and Reset with Pilot Initiate
4) Lockout and Reset with Maximum Cycle Time
5) Lockout and Reset with Reclose Failure Alarm and Pilot Initiate
6) Lockout and Reset with Reclose Failure Alarm and Maximum Cycle Time
7) Lockout and Reset with Pilot Initiate and Maximum Cycle Time
8) Lockout and Reset with Reclose Failure Alarm, Pilot Initiate, and Maximum Cycle Time

CONTROL OUTPUTS
0) None
A) Instantaneous Trip Enable - N.O. Contact
B) Block LTC-N.C. Contact
C) ITE-N.O. Contact Block LTC-N.C. Contact
D) ITE-N.C. Contact
E) ITE-N.C. Contact Block LTC-N.C. Contact
F) ITE-N.O. (Cold Load)
G) ITE-N.O. (cold Load) Block LTC-N.C. Contact
H) ITE N.O. BLTC N.O.
I) ITE N.C. BLTC N.O.

RECLOSE TIME DELAY
A6) 0.1-99.9 sec.

A7) 0.1-99.9 sec. (1st T.D.) 1-999 sec. (2nd & 3rd T.D.)

A8) 0.03-0.99 sec (Pilot) 0.1-99.9 sec. (1st, 2nd & 3rd T.D.)

△2

POWER SUPPLY
J) 125 Vdc 100/120 Vac
K) 48 Vdc
L) 24 Vdc
Y) SWITCHABLE 48Vdc OR 125Vdc
Z) 250 Vdc 230 Vac

RESET TIMER
C) Time Delay 10-1000 sec
D) Time Delay 1-100 sec

OPTION 1 SPECIAL CONTACT ASSIGNMENT
O) Standard
1) Reset Inhibit △3
2) Reclose Wait
3) Pre-Lockout △3
4) Reclose Permissive

OPTION 2
L) Non-Isolated Contact Sensing Input
M) Isolated Contact Sensing Input

OPTION 3
0) None

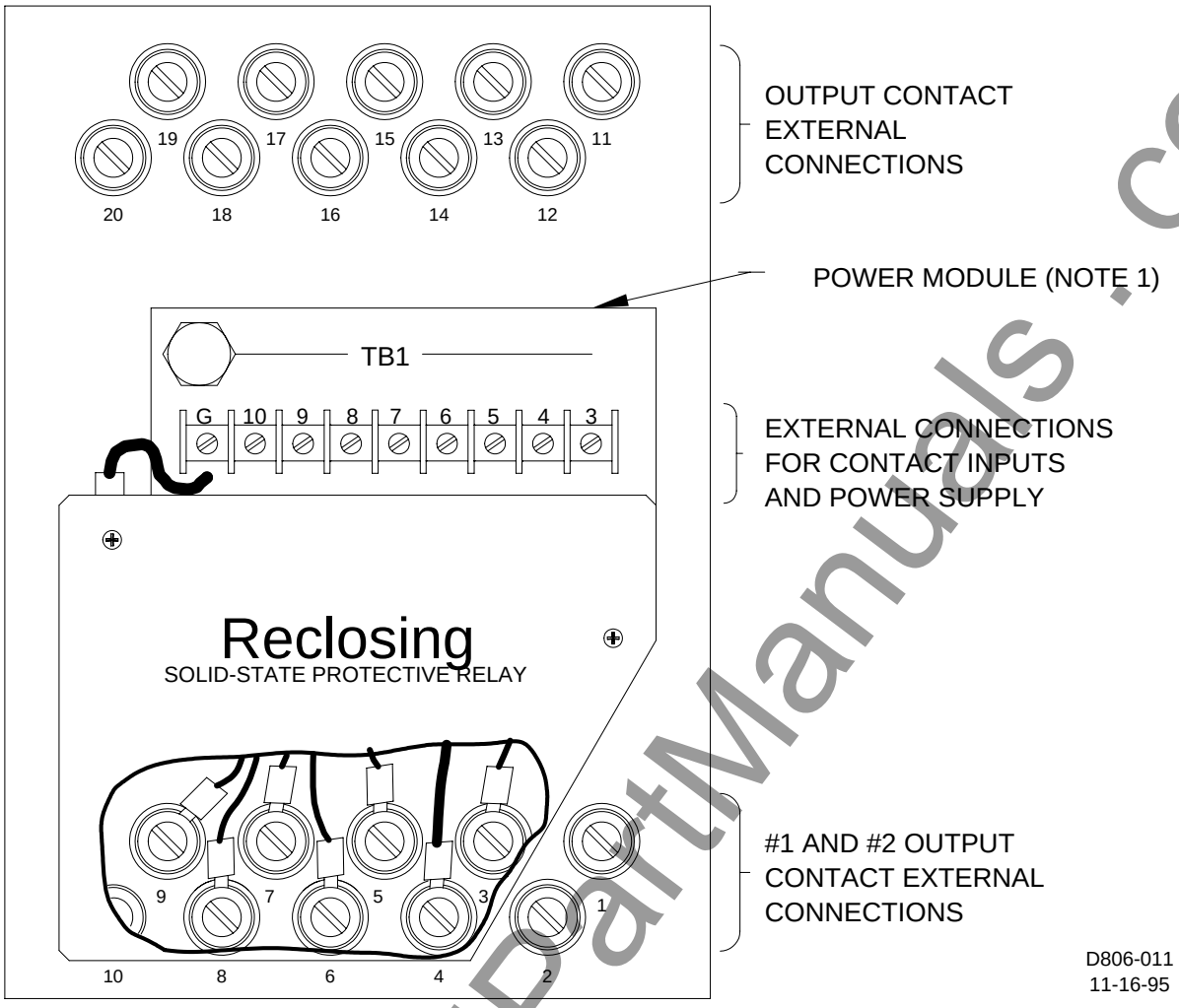
OPTION 4
F) Semi-Flush Mounting
P) Projection Mounting

NOTE:

△2 Pilot Initiate Option required (L.O. & Reset must be 3, 5, 7, 8)

△3 Not available with Pilot Initiate (L.O. & Reset must be 1, 2, 4, or 6)

BE1-79M
D677-004
1-17-97



NOTE:

1. When projection mounting has been selected, the power module must be removed prior to installation and then attached to the rear of the mounting panel after the relay has been installed. External contact sensing inputs are then wired to the power module.

Figure 8-1. External Connections

TEST PLUG ADAPTER

Function

Relays revision D and previous have voltage-dropping resistors mounted externally on the back side of the case. These resistors are part of the internal circuitry, despite their external location. When using test plug, (Basler part number 10095), with these relays, compensating resistors must be added. For ease of use, Basler Electric has manufactured test plug adapters with internal compensating resistors. Table 8-1 provides the appropriate test plug adapter part number for each power supply type. The test plug adapter is shown attached to the test plug in Figure 8-3. The adapter should be attached to the test plug before it is inserted into the relay.

If the correct adapter is not available, a test setup may be improvised by inserting the proper resistors in series with certain test plug terminals as shown in Figure 8-4. Notice that supplementary terminals (not supplied by Basler Electric) have been added for convenience in making the connections.

Table 8-1. Test Adapters

Power Supply Type	Test Adapter Part Number
24 V	None required
48 V	9170111100
125 V	9170111102
230 V	9170111104*

(*) CAUTION

The surface of 230 V units may become hot.

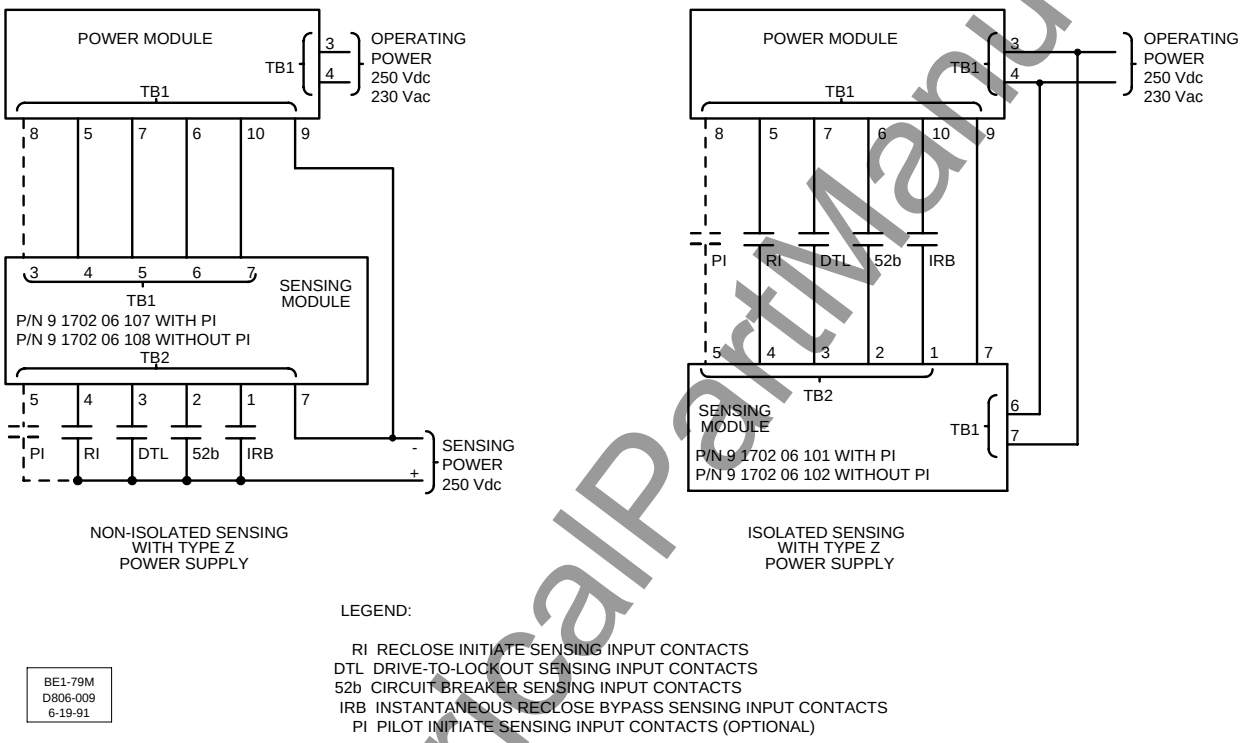


Figure 8-2. Sensing Input Connections

ASSEMBLING ADAPTER TO TEST PLUG

STEP 1. Remove top and bottom covers of test adapter by removing the 4 retaining screws.

STEP 2. Remove ten black thumbnuts from test plug.

STEP 3. The studs of the test plug may be entered into the ten matching holes of the adapter. Before assembling the test plug to the adapter, it necessary to orient the two units to each other by holding the black side of the test plug UP as it engages the adapter. (The adapter itself is held topside UP - i.e. front panel letters are upright)

STEP 4. Replace the ten black thumbnuts. Firmly hand-tighten each thumbnut.

STEP 5. Replace top and bottom covers and fasten using 4 retaining screws removed in step 1.

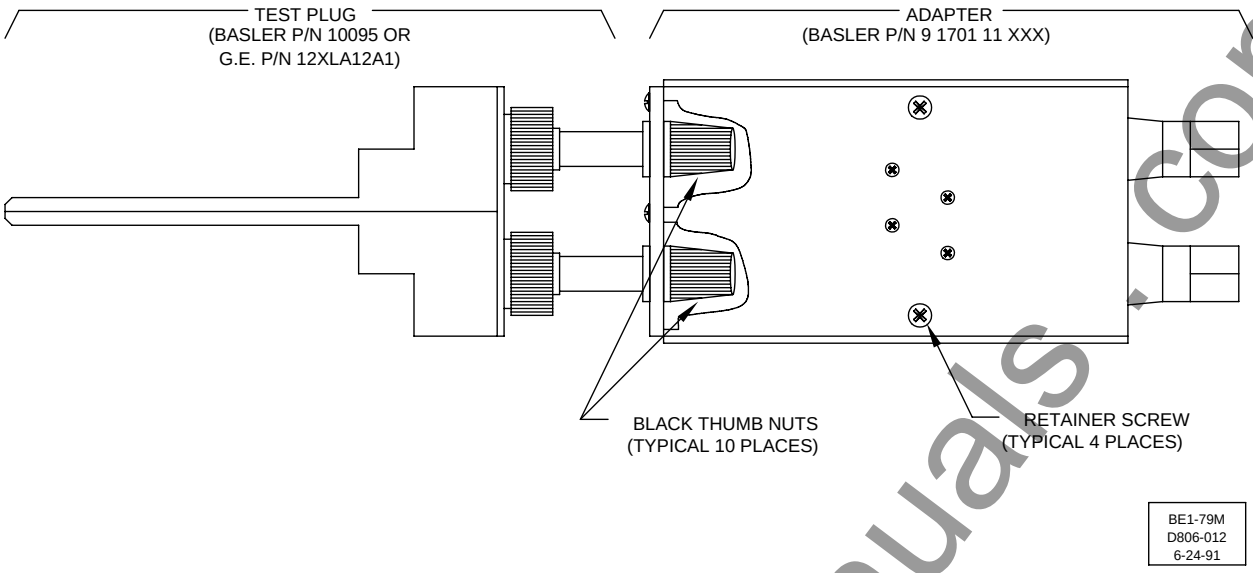


Figure 8-3. Test Plug and Adapter

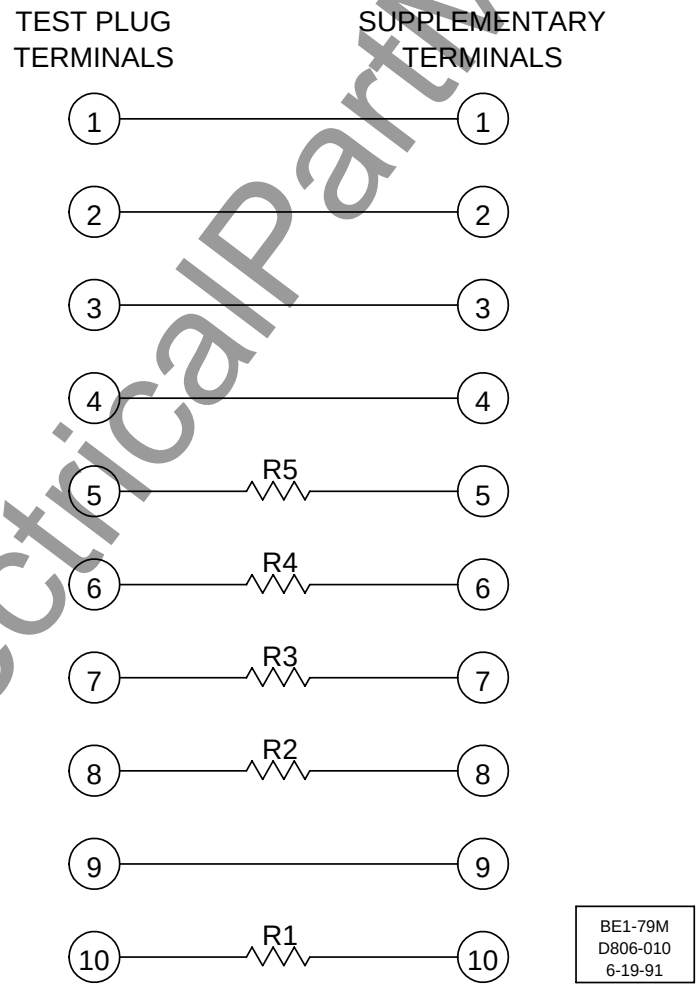


Figure 8-4. Improvised Test Setup

This page intentionally left blank.

Basler Electric
ROUTE 143, BOX 269
HIGHLAND, IL 62249 USA
http://www.basler.com, info@basler.com
PHONE +1 618-654-2341 FAX +1 618-654-2351