

**BE1-25/79TR  
SYNC-CHECK  
RECLOSING RELAY  
(MODULAR UNIT)**

The BE1-25/79TR relay integrates all the components of a reclosing system into one compact microprocessor package. It is designed for use on transmission systems, utility interties and distribution systems with cogeneration.

**ADVANTAGES**

- Replaces mechanical repeat cycle timer schemes
- May be adapted for various reclosing schemes.
- Field programmable (using contact sensing inputs).
- Can be programmed to work with any substation arrangement.
- Versatile enough for a fully automated transmission system.
- Built-in test provisions on sensing inputs and control outputs (optional).
- Dual redundant power supplies (optional).
- 19" rack mount case (vertical unit available).
- Occupies only 8.2 inches of space behind panel.
- Serial port communications for testing data collection and automated setting of parameters (front & rear).

**ADDITIONAL INFORMATION**

**INSTRUCTION MANUAL**  
Request Publication 9-2681-00-990

**SERVICE MANUAL**  
Request Publication 9-2681-00-620

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## FEATURES

The BE1-25/79TR Sync-Check Reclosing Relay is a microprocessor based relay providing transmission line systems with automated reclosing, voltage monitoring and sync-checking capabilities.

The relay is field programmable (using contact sensing inputs) to provide the desired characteristics required for the specific transmission line system. Relay timing is set (programmed) into the relay using front panel mounted switches. In addition, automatic reclosing is not limited to one shot. The BE1-25/79TR has two shot capabilities.

A BE1-25/79TR relay is similar in principle to a mechanical repeat cycle timer where various operations are permitted as the cam is rotated. The capabilities of this relay are equivalent to and exceed mechanical relays used in automatic transmission line systems.

**The BE1-25/79TR relay has the following functional features:**

### RECLOSING

- Two separate line test reclosings (dead line and live bus)
- Two separate restore power reclosings (live line and dead bus).
- Two time delays for line test and restore power reclosings.
- Parallel (live line and live bus) and parallel with sync-check and voltage monitor.
- High speed reclose (in cycles) and high speed reclose with sync-check supervision.
- Eight targets for line test, restore power, parallel, high speed reclose, power failure and lockout.
- Twelve character front panel mounted display indicates (in conjunction with front panel LEDs) relay status.
- Reclose time delay can be interrupted by counter enable (CE) contact sensing input.
- Memory output relays for line test, restore power.

### SYNC-CHECK/VOLTAGE MONITOR

- Live line condition.
- Dead line condition.
- Live bus condition.
- Dead bus condition.
- Delta voltage.
- Phase difference.
- Slip frequency.
- Sync-check output relay.

### TRIPPING

- Power fail condition (dead line and dead bus).
- Automatic reclose time delay interruption when dead line, dead bus and open breaker are detected.

**The BE1-25/79TR has the following features for ease of use and testing:**

### EASE OF TESTING

- Switch to disconnect control inputs and permit injection of test signals through test points on front panel (figure 1).
- Removable connection plug on voltage inputs and trip and close outputs.

### EASE OF USE

- Menu driven controls and bright LED display (figure 2).
- Four outputs may be programmed for any one of the following conditions:
  - Line Test 1 (LT1)
  - Line Test 2 (LT2)
  - Restore Power 1 (RP1)
  - Restore Power 2 (RP2)
  - Dead Bus-Dead Line (DB-DL)
  - Dead Bus-Live Line (DB-LL)
  - Live Bus-Dead Line (LB-DL)
  - Live Bus-Live Line (LB-LL)

### COMMUNICATIONS

- Menu-based system operates with readily available PC modem software that emulates a dumb terminal. Menu system is shown in Figure 3.

# FEATURES

(continued)

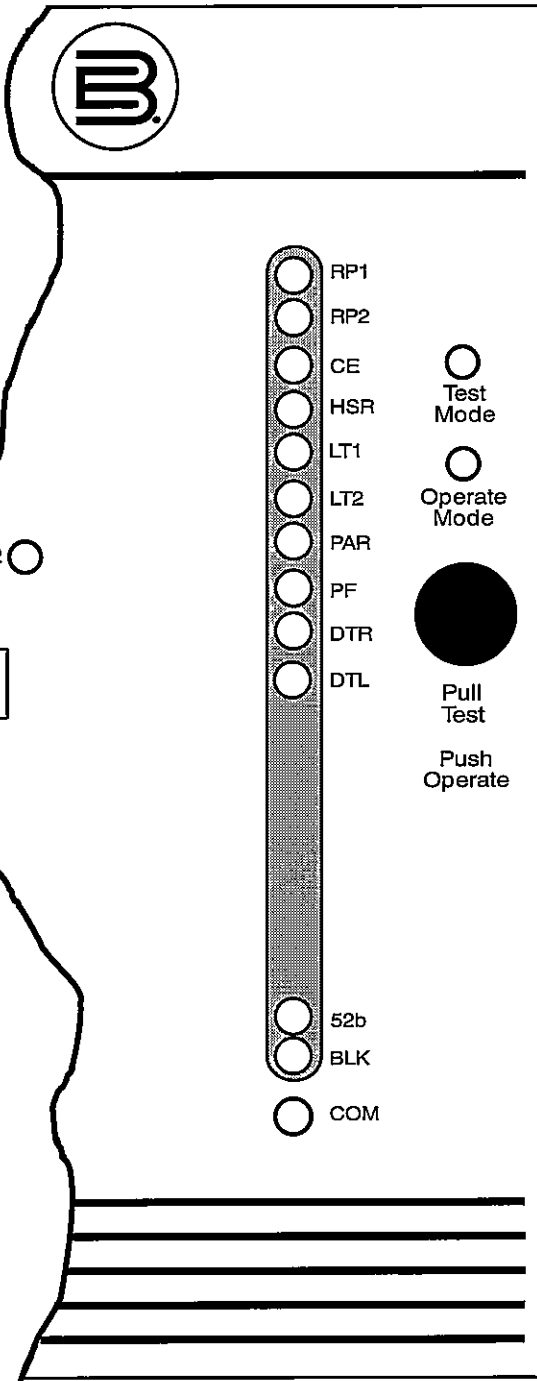


Figure 1 - Front Panel Test Points

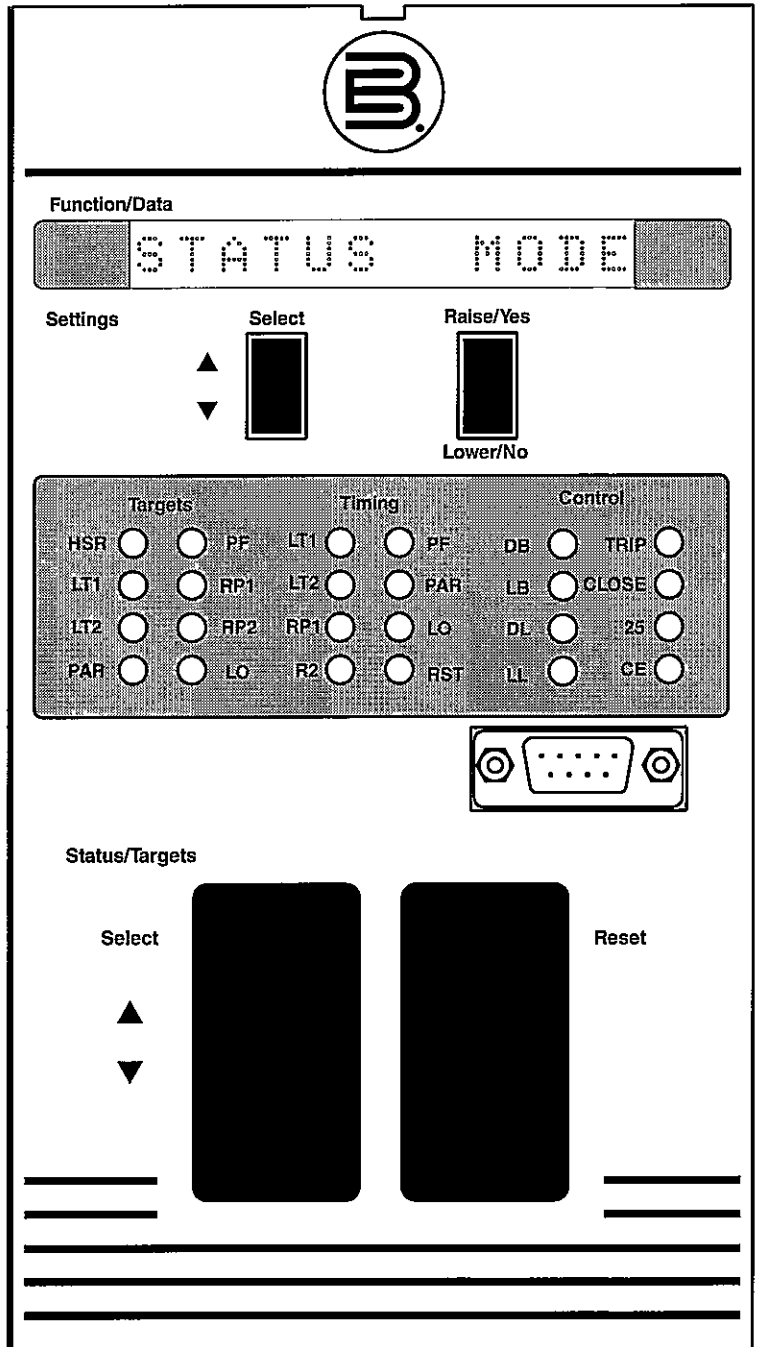


Figure 2 - Control Panel

## FEATURES

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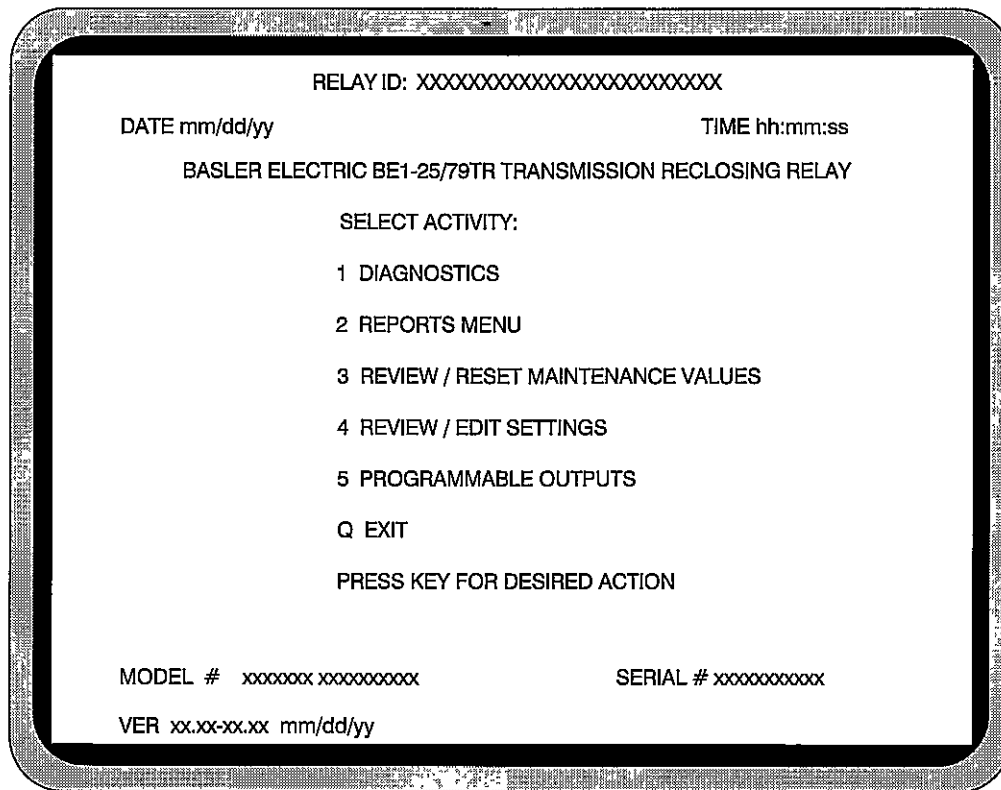


Figure 3 - Main Menu Screen

This main menu screen allows you to select the desired activity. The choices are:

1. DIAGNOSTICS - Observe the status of power supply 1 and 2, A/D converter, RAM, ROM, EEPROM CAL numbers, SYS FREQ setting, LINE voltage magnitude, BUS voltage magnitude, voltage difference, phase angle difference and frequency slip difference. This selection requires the DIAGNOSTIC PASSWORD for entrance to the screen.
2. REPORTS MENU - Two types of report forms are available from this menu. A detailed report form or a summary report form. Reports are available for each record stored in the relay. Each record includes one or more events.
3. RESET MAINTENANCE VALUES - This screen provides a means for the user maintenance personnel to reset the number of breaker operations associated with breaker maintenance and the events stored for record report storage. Passwords, Line#, Station#, Breaker# and Relay ID are also defined in this screen for report generating and entry/exit into other screens.
4. REVIEW/EDIT SETTINGS - Define, review, or change relay operational settings. This selection requires the EDIT SETTINGS PASSWORD for entrance to the screen.
5. PROGRAMMABLE OUTPUTS - Define conditions for four programmable outputs. This selection requires the EDIT SETTINGS PASSWORD for entrance to the screen.
- Q. EXIT - This will cause access to the relay to be terminated.

# APPLICATION

The BE1-25/79TR provides automatic reclosing for transmission systems, utility interties and distribution systems with cogeneration.

The relay is field programmable via contact sensing inputs to provide the characteristics required when system conditions change. This capability is required to fully automate a transmission system.

The BE1-25/79TR provides one or two shot reclosing capabilities with sync-check and voltage monitoring functions. The unit accepts various control inputs and is capable of tripping when both line and bus are dead.

## RECLOSING CAPABILITIES

- One or two shots.
- High speed reclose.
- Parallel (live line and live bus).
- Restore power (live line and dead bus).
- Line test (dead line and live bus).

## SYNC-CHECK CAPABILITIES

- Checks phase angle between line and bus.
- Includes timer.
- Phase window setting.
- Slip frequency window setting.

## VOLTAGE MONITOR CAPABILITIES

- Live line.
- Dead line.
- Live bus.
- Dead bus.
- Delta voltage.

## TRIPPING FUNCTION

- Trip breaker when both line and bus are dead.
- Enabled by contact external to relay (PF).

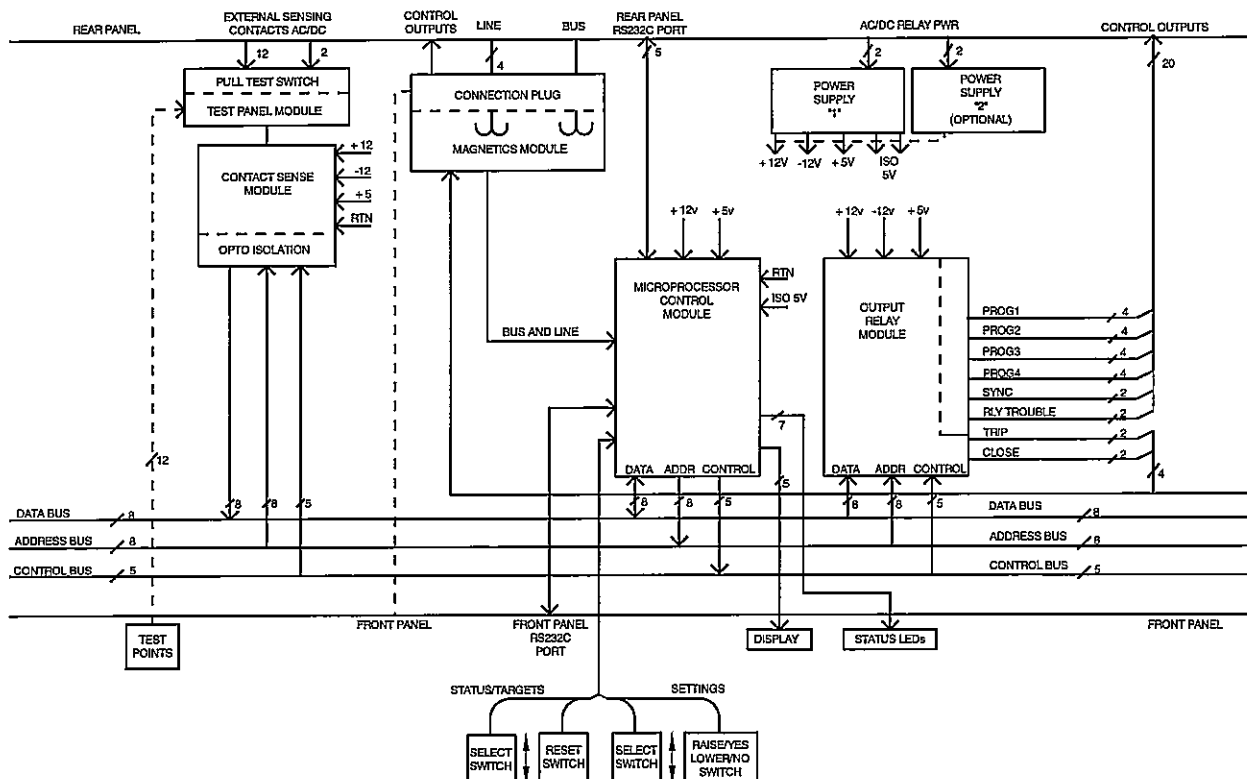
## CONTROL VIA EXTERNAL INPUTS

- Enable/freeze timers (CE).
- Drive to lockout (DTL).
- Drive to reset (DTR).
- Enable/disable power fail tripping (PF).

## TIMING FUNCTIONS

- Window for reclosing sequence (MASTER).
- Reset timers (RST1, RST2).
- Lockout timer (LO).
- Reclose timers (LT1, LT2, RP1, RP2, PAR).
- High speed timer (HSR).
- Sync-check timer (SYNC).
- Dead line and bus condition timer (PF).
- Close Output (Close TD)
- Loss of Potential (LOP TD)

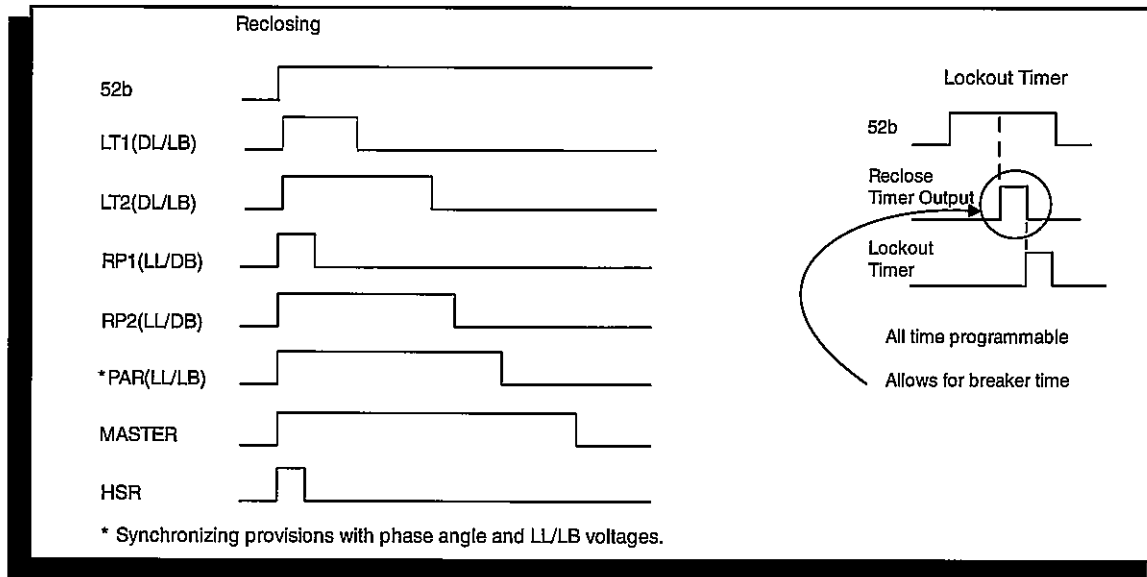
# FUNCTIONAL BLOCK DIAGRAM



## FUNCTIONAL DESCRIPTION

### TIMING CHART

The chart below shows that the timing sequence is the same as that used for electromechanical repeat cycle timers.



### RECLOSING

Timing for reclosing begins when either the breaker opens (52b closes) or the high speed reclose (HSR) input closes momentarily. This causes the master timer and all reclose timers (LT1, LT2, RP1, RP2 and PAR) which were made active by control inputs to begin counting down.

The master timer defines a window during which a close output may be initiated by one or more reclose timers. The duration of the timer and close output pulse are established during setup.

Reclose action will occur as long as the conditions for reclose are satisfied before a particular reclose timer times out. The conditions associated with each reclose timer are established during setup. They include live or dead conditions on line and bus and status of breaker. The PAR reclose timer also includes conditions for delta V and phase angle across the open breaker.

Once a reclose output is initiated, and the time established for the breaker to operate expires, a lockout timer (LO) is initiated. If the breaker is open (52b closed) when the lockout timer times out, the relay will go to lockout. At that point, the breaker must be closed manually.

After the master timer times out, the status of the breaker (52b contact) is checked. If the breaker remains closed for a time established for timer RST1, then the system will be reset. If the breaker remains open for the time established for RST2 with live line, live bus and PAR input open (disabled), then the system will be reset.

### TRIPPING

A power fail timer (PF) is initiated when both line and bus go dead when the breaker is closed. If these conditions remain after the power fail timer times out, a trip output will be issued. If the breaker opens, all timing freezes.

### CONTROL OUTPUTS

A form A output relay is provided for the sync-check/voltage monitor function. The output contact closes when the phase angle and voltage are within the limits set for permitting reclose while the breaker is open. This output may be used to supervise other devices in the station.

Form C memory output relays are provided for PROG1, PROG2, PROG3 and PROG4. A relay is energized and latched when a reclose occurs corresponding to the associated function. The relay remains latched until the reclosing function is reset. These outputs are used in the logic of schemes requiring more than one 25/79TR to test the bus.

### CONTROL INPUTS

External contacts may be used to enable or disable the power fail (PF) tripping function. Also, a counter enable (CE) input may be used to freeze all timers. The timers resume timing when the (CE) input is closed. The relay may be driven to lockout with the DTL input or to reset with the DTR input.

### ALARM OUTPUT

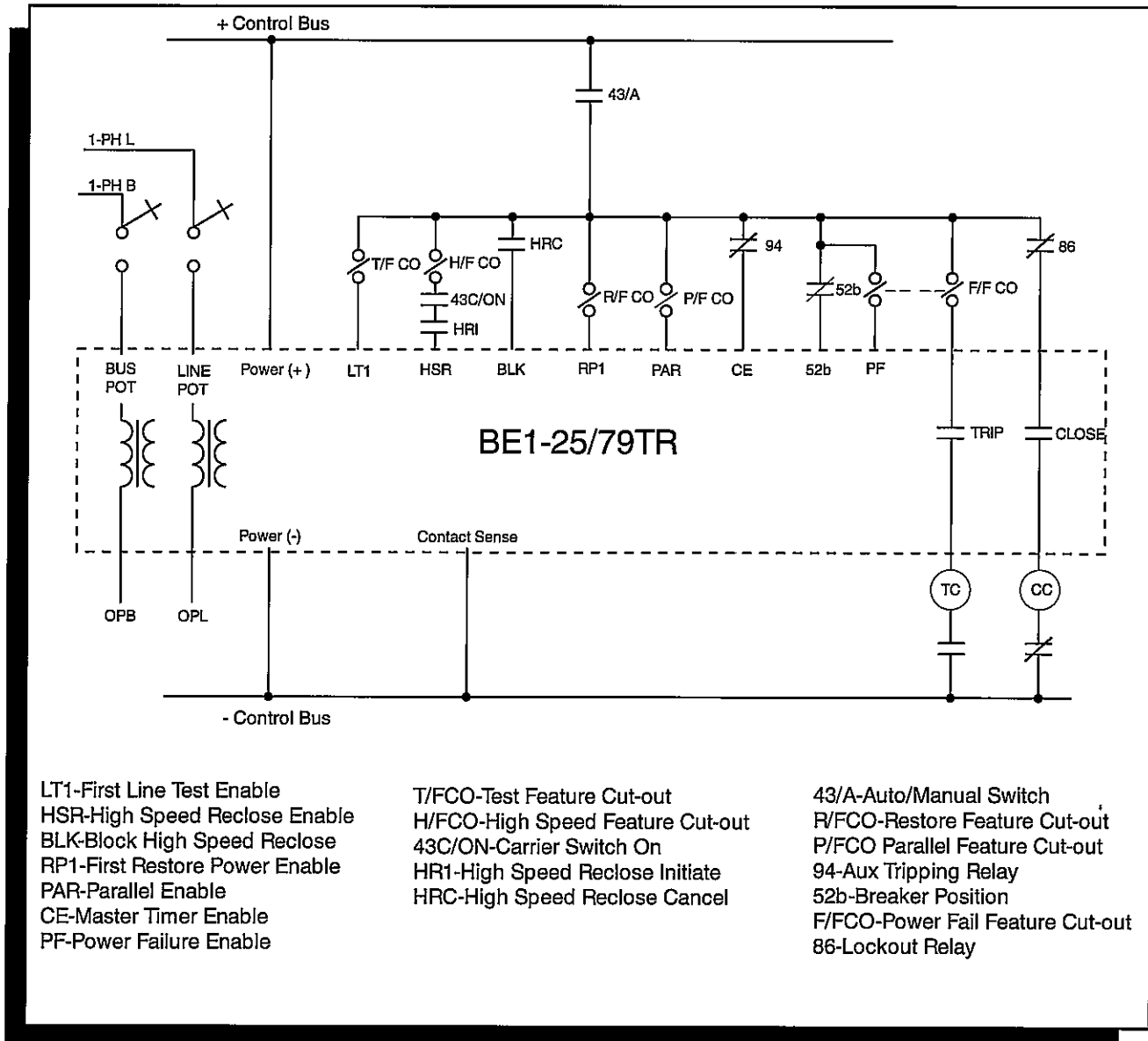
A form B output relay is provided for a trouble alarm. The contact is held open as long as the electronics receives proper operating voltages.

## FUNCTIONAL DESCRIPTION

(continued)

### TYPICAL CONNECTIONS

The integrated capabilities of the BE1-25/79TR simplifies wiring over what is required with individual relays. Typical wiring connections are shown below.



### Additional Inputs not used in connections shown above

- Drive To Lockout (DTL).
- Line Test 2 (LT2).
- Drive to Reset (DTR).
- Restore Power 2 (RP2).
- Alternate control power input for relay power supply.

### Outputs not used in connections shown above

- One sync-check/voltage monitor relay (Form A)
- Four programmable memory output relays (Form C).
- One relay trouble alarm (Form B).

## SPECIFICATIONS

### POWER SUPPLY INPUTS

#### RANGE

+ 125 Vdc (62 to 150 Vdc) or 120 Vac (90 to 132 Vac).

#### BURDEN

Burden at 60 Hz, 120 Vac is 19 VA and burden at 125 Vdc is 14 watts.

### VOLTAGE AND PHASE SENSING INPUTS

#### RATING

Nominally rated at 60 Hz with a range of 55 to 65 Hz at a maximum burden of 1 VA per phase to 125% of nominal voltage.

#### RANGE

1 to 135 Vac. Maximum continuous voltage rating is 160% of nominal.

#### CONFIGURATION

Bus and line voltage sensing inputs are isolated. Two inputs are required. One for line potential and one for bus potential.

### PHASE ANGLE

#### SELECTION ACCURACY

$\pm 1.0^\circ$  for a nominal input frequency of 60 Hz, with an input range of 10 to 135 volts at 25° C.

#### SETPOINT ACCURACY

$\pm 1.0^\circ$  from a reference measurement at 25° C, at nominal input frequency and levels, over the specified operating range of temperature and input voltages.

### VOLTAGE DIFFERENCE

#### RANGE

Continuously adjustable over the range of 1 to 135 Vac.

#### ACCURACY

$\pm 5.0\%$  or  $\pm 1.0\text{ V}$  whichever is greater.

### LINE AND BUS VOLTAGE MONITOR

#### RANGE

Continuously adjustable over the range of 10 to 135 Vac.

#### ACCURACY

$\pm 5.0\%$  or  $\pm 1.0\text{ V}$  whichever is greater.

### CONTACT SENSING INPUTS

User-supplied contacts with a minimum rating of 0.05A at 250 Vdc are required at all contact sensing inputs.

Sensing requires an externally applied dc sensing voltage equal to the nominal voltage of the relay power supply input.

Contact recognition is adjustable from 8 to 200 milliseconds in 2 millisecond increments

Line Test 1 (LT1).

Line Test 2 (LT2).

Restore Power 1 (RP1).

Restore Power 2 (RP2).

Parallel Enable (PAR).

Power Failure Enable (PF).

Breaker position (52b).

Counter enable (CE).

High Speed Reclose Enable (HSR).

Block High Speed Reclose (BLK).

Drive to Lockout (DTL).

Drive to Reset (DTR).

### SERIAL PORT COMMUNICATIONS

Front and rear panel mounted connectors (9-pin, D subminiature) for expansion of testing, data collection and setting of parameters.



## SPECIFICATIONS

(continued)

### TIME DELAYS

Timing tolerance for HSR timer is  $\pm 5\%$  or two cycles whichever is greater. All other timer tolerances are  $\pm 5\%$ .

Number of Delays	Function	Range
2	Line Test (LT1, LT2)	1-999 seconds
2	Restore Power (RP1, RP2)	1-999 seconds
1 $\Delta$	Parallel (PAR)	1-999 seconds
1	Sync-check (SYNC)	1-999 cycles
1	High Speed Reclose (HSR)	1-99 cycles
1 $\Delta$	Power Fail (PF)	1-99 seconds
2 $\Delta$	Reset Time (RST1, RST2)	1-999 seconds
1	Lockout Time (LO)	1-999 seconds
1 $\Delta$	Master Time (MASTER)	1-999 seconds
1	Close Output (Close TD)	1-999 seconds
1 $\Delta$	Loss of Potential (LOP TD)	0.01-9.99 seconds

- $\Delta$  If the breaker is intended to operate open (Parallel disabled) then the relay will go to reset after the master timer times out and RST2 time expires. The bus and line must both be energized, and the PAR input open.
- $\Delta$  The power failure function is a tripping function and will not start the master timer.
- $\Delta$  The master timer will be used similar in principle to the mechanical repeat cycle (R.C.) timer in which various operations are permitted as the cam rotates. If lockout has not been reached in the preset time allowed, the master timer will time out and determine whether to go to lockout or reset depending upon the state of the breaker and if the bus and line are live with PAR input disabled.
- $\Delta$  This timer is used to inhibit a line test (LT1 or LT2) or restore power (RP1 or RP2) reclose if the bus or line potential goes dead and the breaker remains closed (no 52b input) for the LOP TD. A setting of 0 inhibits this function from preventing the reclose.

## SPECIFICATIONS

(continued)

### OUTPUTS

#### TRIP

One tripping contact with N.O. configuration.

#### CLOSE

One closing contact with N.O. configuration.

#### SYNC

The sync-check (PAR) function with voltage measuring circuits has one output relay with a N.O. configuration.

#### MEMORY

There are four memory output relays, each with form C contacts. These relays may be programmed for any one of the following:

- Line Test 1 (LT1)
- Line Test 2 (LT2)
- Restore Power 1 (RP1)
- Restore Power 2 (RP2)
- Dead Bus-Dead Line (DB-DL)
- Dead Bus-Live Line (DB-LL)
- Live Bus-Dead Line (LB-DL)
- Live Bus-Live Line (LB-LL)

#### RT ALM

One N.C. output relay that closes for internal microprocessor failure or power supply failure.

### OUTPUT CONTACT RATINGS

#### RESISTIVE

120/240 Vac makes 30 A for 0.2 seconds, carry 7 A continuously, break 7 A.  
 250 Vdc makes and carry 30 A for 0.2 seconds, carry 7 A continuously, break 0.3 A.  
 500 Vac makes and carry 15 A for 0.2 seconds, carry 7 A continuously, break 0.1 A.

#### INDUCTIVE

120/240 Vac breaks 0.3 A, inductance/resistance (L/R) ratio = 0.04.  
 125/250 Vdc breaks 0.3A, inductance/resistance (L/R) ratio = 0.04.

### TARGETS

Eight LEDs (red) on the front panel status display. The targets are:

High Speed Reclose (HSR).	Restore Power 1 (RP1).
Power Failure (PF).	Restore Power 2 (RP2).
Line Test 1 (LT1).	Parallel (PAR).
Line Test 2 (LT2).	Lockout (LO).

### INDICATORS

#### TIMING

Seven timing LEDs (green) are used to indicate when a function is timing. The LEDs are:

Line Test 1 (LT1).	Parallel (PAR).
Line Test 2 (LT2).	Power Failure (PF).
Restore Power 1 (RP1).	Lockout (LO).
Restore Power 2 (RP2).	

#### STATUS

One LED (green) and four LEDs (yellow) indicate relay status. The green LED (RST) indicates the relay is in reset. The four yellow LEDs indicate the bus and line status. They are:

Dead Bus (DB).	Dead Line (DL).
Live Bus (LB).	Live Line (LL).

#### CONTROL

Four LEDs (yellow) indicate relay control status.

Trip.	Sync-Check Function (25).
Close.	Control Enable (CE).

### ISOLATION

1500 Vac at 60 Hz for one minute in accordance with IEC 255-5 and ANSI/IEEE C37.90-1989 (Dielectric Test).

### SURGE WITHSTAND CAPABILITY

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.

### RADIO FREQUENCY INTERFERENCE (RFI)

Field tested using a five watt, hand-held transceiver operating at random frequencies centered around 144 MHz and 440 MHz, with the antenna allocated six inches from the relay in both horizontal and vertical planes.

### TEMPERATURE

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

### IMPULSE TEST

Qualified to IEC 255-5.

### WEIGHT AND CASE SIZE

13.7 pounds maximum.  
 19 inch rack mount.  
 Height requirement = 8.75 inches (5 rack units).  
 Depth behind mounting surface = 8.2 inches.

## ORDERING

ORDER BY MODEL NUMBER FROM THE TABLE BELOW.

9 2681 00 108	Built-in Test	Horizontal	Dual 120 Vac/125 Vdc
9 2681 00 111	Built-in Test	Horizontal	Dual 48 Vdc
9 2681 00 112	Built-in Test	Vertical	Dual 120 Vac/125 Vdc
9 2681 00 115	Built-in Test	Vertical	Dual 48 Vdc
9 2681 00 200	Demo Unit	Horizontal	Dual 120 Vac/125 Vdc
9 2681 00 120	Non-testable	Horizontal	Single 120 Vac/125 Vdc
9 2681 00 121	Non-testable	Horizontal	Single 48 Vdc
9 2681 00 122	Non-testable	Vertical	Single 120 Vac/125 Vdc
9 2681 00 123	Non-testable	Vertical	Single 48 Vdc
9 2681 00 124	Built-in Test	Horizontal	Single 120 Vac/125 Vdc
9 2681 00 125	Built-in Test	Horizontal	Single 48 Vdc
9 2681 00 126	Built-in Test	Vertical	Single 120 Vac/125 Vdc
9 2681 00 127	Built-in Test	Vertical	Single 48 Vdc

### STANDARD ACCESSORIES

A test set is available for providing input power and signals for a full functional test. The test set includes switches to manually activate sensing inputs and indications for trip and close outputs.

The user must fabricate a harness to make connections between the test box and the relay. The connections to the relay would be made using a test paddle for voltage inputs and trip & close outputs and tip-plugs for control inputs.

To order the test set, specify part number 9-2315-42-101.

The demo unit is a model 9-2681-00-108 with the test set attached and wired to the relay.

### SPECIAL REQUIREMENTS

The standard unit mimics mechanical repeat cycle schemes. However, the unit is microprocessor based and may be equipped with software for virtually any scheme. Contact Basler to determine if the BE1-25/79TR can be adapted to your needs.

