



## BE1-25 Sync-Check Relay

The BE1-25 Sync-Check Relay monitors the voltages on both sides of a circuit breaker and determines that proper phase angle and voltage exist prior to closing the circuit breaker.

### FEATURES

- Phase angle limit is adjustable over the range of 1 to 99 degrees.
- Time delay is adjustable over a range of 1 to 99 cycles or 0.1 to 99 seconds.
- Voltage monitoring circuits provide independent determination of bus and line voltage levels for selectable closing conditions.
- Voltage difference provides additional verification of proper breaker closing conditions.
- Expandable phase window option provides the capability to quickly close critical system ties under emergency conditions.
- Separate sync and voltage monitor output contacts are available.
- Optional external selection of voltage conditions.
- Qualified to the requirements of
  - IEEE C37.90-1978, C37.90a-1974, and IEC 255 for surge withstand capability;
  - IEEE C37.90.1-198X for fast transient;
  - IEC 255-5 for impulse.
- UL Recognized under Standard 508, UL File #E97033.
- Five year warranty.

### ADDITIONAL INFORMATION INSTRUCTION MANUAL

Request publication 9170200990

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**B** Basler Electric

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UBP-5  
1-01

# APPLICATION

The primary application of this relay is in situations that require verification that synchronism exists prior to closing a circuit breaker. These include the paralleling of a generator to a system, reestablishing an intercon-

nection between two parts of a power system, and supervision of fast transfer schemes where fast pickup and dropout of the phase measuring circuit and required.

# DESCRIPTION

## General

The basic BE1-25 is a solid state synchronism check relay, designed to permit breaker closure only after the specified phase angle conditions have been verified and the condition satisfied for a specified time period. The design provides for ease of setting the phase angle and time period requirement through front panel thumbwheel switches. The design also includes up to five optional voltage measuring circuits to verify various line and bus voltage conditions prior to permitting breaker closure.

The BE1-25 Sync-Check relay is designed to measure the phase angle between the monitored single phase voltages on the line and bus sides of a breaker and verify this angle is less than or equal to the front panel setting. If the measured angle has met this criteria for the time period defined by the front panel setting, the output relay is energized and the breaker will be

permitted to close. The allowable phase angle is adjustable over the range of 1 to 99 degrees. The time delay requirement is adjustable over either of two ranges: 1 to 99 cycles, 50/60 Hz (using the bus frequency as the reference); or, 0.1 to 99 seconds (using the internal crystal reference). (See Figure 1).

An optional target may be specified to indicate operation of the sync-check function.

In order to control the operation of the relay, one additional input (in addition to the Bus and Line potentials and power supply) is required. This input defines the position of the circuit breaker. If the breaker is open the relay will perform its function. When the breaker closes this input changes state and deenergizes the output. This input uses a contact of the breaker (52b) to define position. Two configurations of this input's circuitry – Isolated contact sensing and Nonisolated contact sensing – provide additional flexibility to the control/protection circuit designer. With isolated contact sensing, the relay monitors a current through a dedicated contact. With non-isolated contact sensing, the relay senses the presence of voltage at its input due to the closure of a non-dedicated contact.

## Voltage Monitoring

To supplement the basic sync-check function of the BE1-25, optional voltage measuring circuits may be included. These include magnitude measurements of the line and bus inputs, which may be used by the voltage monitoring logic to determine whether the input is live, dead or overvoltage. CONDITION switches, either on the voltage monitor card or external to the relay, determine the desired relay response to these voltage conditions. MODE switches are included on the voltage monitor card to define the desired mode of operation for the Dead Bus/Bus Not Overvoltage (DB/OV) measuring elements. One MODE switch is provided for each voltage input so that the operation of the relay can be tailored to the specific application.

When the MODE switches are in the NORMAL position (up), the two measuring elements associated with an input establish separate live and dead reference levels for the input signal.

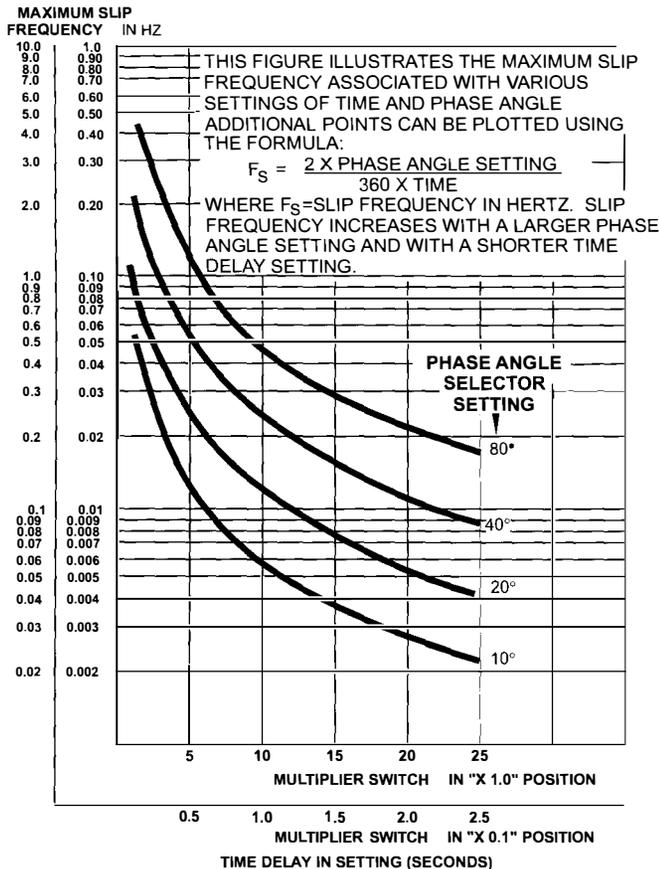


Figure 1 - Slip Frequency vs. Time Delay

## DESCRIPTION, continued

When the MODE switches are in the NOT OVERVOLT-AGE position (down), the two measuring elements associated with each input establish separate dead/live and not-overvoltage reference levels for the input signal. (See Figure 2).

CONDITION switches provide the means of selecting the desired action to be taken by the BE1-25 relay. Switch selections include: Live Line/Live Bus (Sync-Check only), Live Line/Dead Bus, Dead Line/Live Bus, and Dead Line/Dead Bus. When any of the selected voltage conditions have been satisfied, the voltage monitor circuit will energize either the sync-check output relay, or the separate (optional) voltage monitor output relay. (It is installed when specified by the style number).

With this logic, when the MODE switches are in the Normal Position, a DEAD level is defined as a monitored voltage level below the DEAD reference setting. A LIVE level is defined as a monitored voltage above the LIVE reference setting.

When the MODE switches are in the NOT OVERVOLT-AGE position, a DEAD level is defined as a monitored voltage less than the LIVE reference setting, a LIVE level is defined as a monitored voltage greater than the LIVE reference setting and less than the NOT OVERVOLT-AGE reference setting. The input is considered to be Overvoltage when it exceeds this reference setting.

This flexibility allows the relay to be used to permit closing a generator breaker onto a dead bus, as well as, preventing closure if the bus voltage is too high.

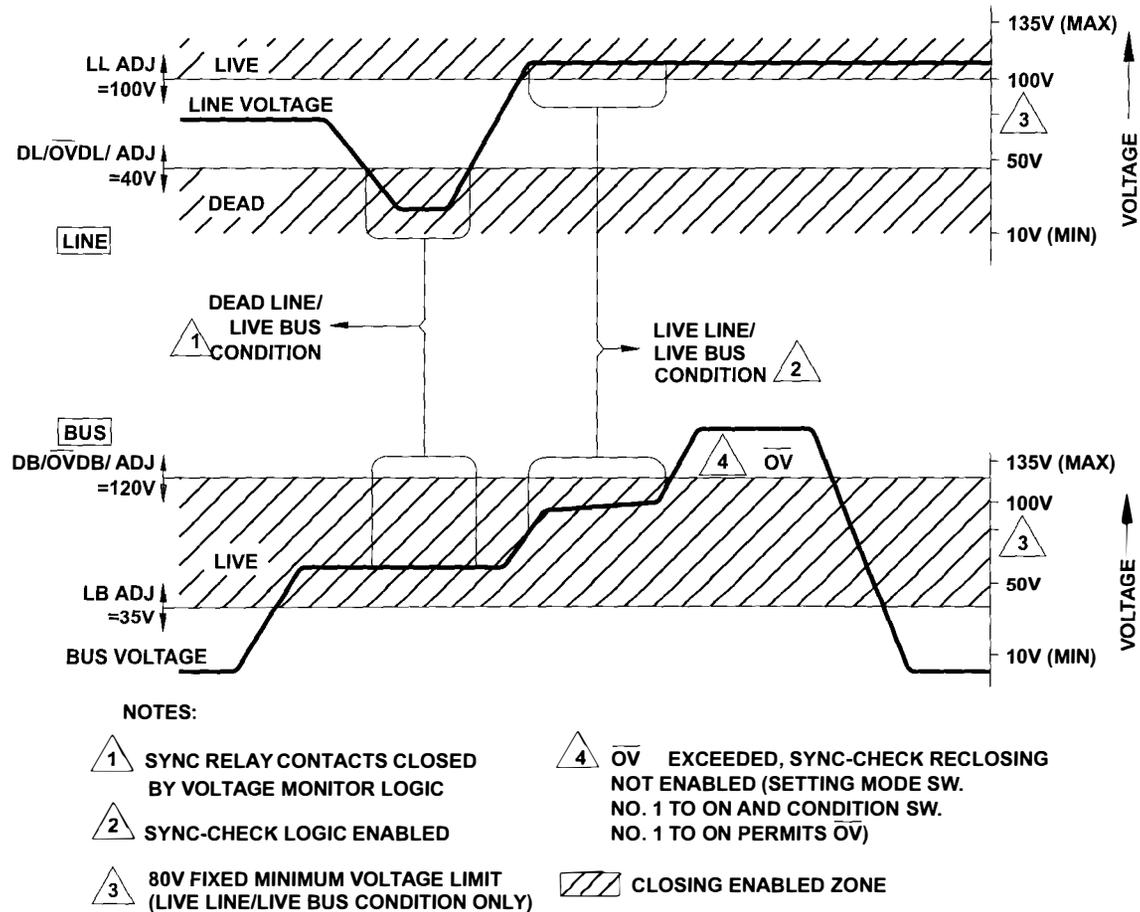


Figure 2 - Voltage Monitor Acceptance Zones

## OPTIONS

### Voltage Difference

Another voltage monitoring function may be included to monitor the vector voltage difference between the two inputs. This function provides an internal backup to the voltage monitoring and sync-check functions to prevent the closure of a generator breaker if this difference is too great even though the phase angle and voltage level monitoring circuits indicate proper closing conditions have been met. See Figure 3.

A separate contact output may be included with the voltage monitoring option when selected by the style number. This contact may be used in the breaker closing circuit to provide a separate supervised closing circuit or indication of the existing voltage conditions to the supervisory control system.

### Push-to-Energize Output

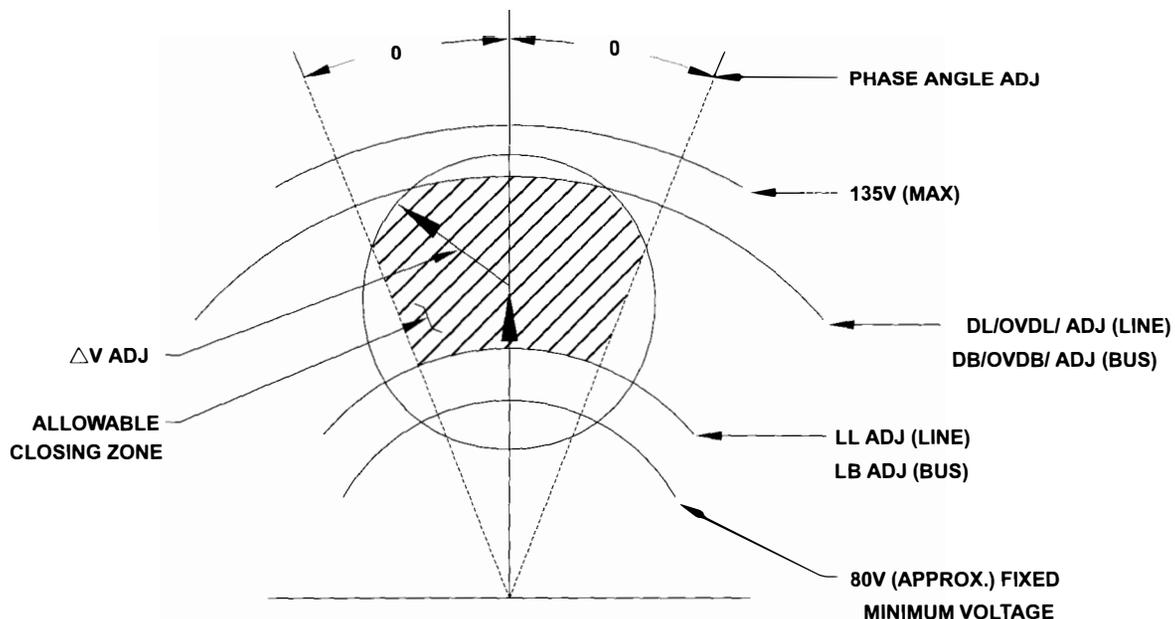
Push-to-Energize Output push buttons are available and provide a means of verifying external output wiring without the inconvenience of having to test the entire relay in the panel for this wiring check. These optional push buttons are provided for each isolated output function within the relay. They are accessible from the front of the relay and actuated by inserting a small nonconductive rod through the metal cover of the cradle assembly.

### Expandable Window

An Expandable Window option is available to enable a local operator, through a switch, or a remote dispatcher, through the supervisory control system to expand the preset phase angle window by a preprogrammed ratio under emergency conditions. Under normal conditions the phase angle setting is determined for a distribution or transmission line breaker by the calculated angular difference that will exist for expected load flow through the total system. Under emergency conditions, the load flow throughout the system may result in an excessive phase angle separation across the controller breaker.

In order to reestablish load on a previously faulted line quickly, it may be necessary to expand the allowable phase window. With this option, closing a contact input to the relay expands the preset phase setting by a preprogrammed multiple. Programming the multiple to 2 or 3 is accomplished by moving a jumper on the circuit card. Opening the contact input restores the phase angle limit to the front panel setting.

For a generator breaker the phase angle setting is determined by the maximum phase difference that can be tolerated by the generator when connected to the system. An excessive angle can result in excessive mechanical forces in the generator and its associated mountings. This option is not suggested for use in generator applications.



Relationship between  $\Delta V$  and  $\Theta$  is:

$$\Delta V = \sin \Theta V_{bus} \quad \Theta = \sin^{-1} \frac{\Delta V}{V_{bus}}$$

Figure 3 - Closing zone Using Voltage Difference, Sync-Check, and Line/Bus Voltage Monitor



## SPECIFICATIONS, continued

Type	O	P	R	T*
Nominal Voltage	48 Vdc	125 Vdc 120Vac	24 Vdc	250 Vdc 230 Vac

\* External modules required for contact sensing when type T power supply is specified.

**Table 1 - Power Supply Options**

Relay Configuration	Burden According to Sources of Operating Power						
	50 Hz 100 Vac	60 Hz 120 Vac	125 Vdc	48 Vdc	24 Vdc	250 Vdc	60 Hz 230 Vac
Without Voltage Monitor	12 VA	18 VA	9 W	9W	9W	12 W	28 VA
With Voltage Monitor	20 VA	26 VA	15 W	15 W	15 W	21 W	41 VA

**Table 2 - Burden**

### OUTPUT CONTACTS

Refer to Bulletin SDA

### Resistive Rating

### ACCURACY

#### Phase Angle

Phase angle selection is within  $\pm 0.5$  or  $\pm 5.0\%$  (whichever is greater) of the front panel setting for degrees, for a nominal input frequency of 50/60 Hz, a sensing input range of 80 to 135 volts, and at  $-25^{\circ}\text{C}$ . Phase angle setpoint accuracy is  $\pm 0.5$  or  $\pm 4\%$  (whichever is greater) from a reference measurement at  $25^{\circ}\text{C}$ , at nominal input voltages of 80 to 130 Vac.

### OPTIONS

#### Timing

The time delay is within 25 msec or 5% of the front panel setting for time (whichever is greater) for a nominal input frequency of 50/60 Hz at  $25^{\circ}\text{C}$ . over the full temperature, voltage, and frequency range, accuracy is  $\pm 10$  mSec or  $\pm 2\%$  (whichever is greater) of the time delay at  $25^{\circ}\text{C}$ . Selection of 00 time delay inhibits the closing of the sync-check output.

Option A6 allows time delay selection in 0.1 second increments over a range of 0.1 to 9.9 seconds, and in 1 second increments over a range of 01 to 99 seconds.

Option A7 provides an adjustable time delay in range of 01-99 cycles in one-cycle increments.

#### Line and Bus Voltage Monitor

The optional voltage monitor circuitry provides four front panel-mounted controls to define live bus, live

line, dead bus, and dead line limit levels. These controls provide continuous adjustment over the range of 10 to 135 Vac. Four condition switches determine the closing conditions that the relay will recognize. Response time is 50 msec or less.

#### Voltage Difference ( $\Delta V$ ) Monitor

The front panel control permits continuous adjustment of the allowable limit of voltage difference between the line and bus voltages over a range of 1-135 Vac. The setpoint shall not vary more than 0.5V or 5% (whichever is greater) from a reference measurement at  $25^{\circ}\text{C}$  with nominal input frequency, and with temperature and voltage within specified operating range. This setpoint shall not vary more than 3% from a reading at  $25^{\circ}\text{C}$  over the limited range of  $+15$  to  $+40^{\circ}\text{C}$ .

#### Targets

Magnetically latched, manually reset, target indicators are optionally available to indicate that an output has tripped. Either internally operated or current operated targets may be specified. Current operated targets require 0.2 A in the output trip circuit to actuate, and trip circuit current must not exceed 20 A for 0.2 seconds, 7 A for 2 minutes, and 3 A continuous. Current operated targets may be selected only when normally open (NO) output contacts have been specified.

#### SURGE WITHSTAND CAPABILITY

Qualified to ANSI/IEEE C37.90a-1974, Surge Withstand Capability Test and IEC 255, Impulse Test and Dielectric Test.

### MECHANICAL

#### Operating Temperature

$-40^{\circ}\text{C}$  ( $-40^{\circ}\text{F}$ ) to  $+70^{\circ}\text{C}$  ( $+158^{\circ}\text{F}$ )

#### Storage Temperature

$-65^{\circ}\text{C}$  ( $-85^{\circ}\text{F}$ ) to  $+100^{\circ}\text{C}$  ( $+212^{\circ}\text{F}$ )

#### Weight

13.5 pounds maximum

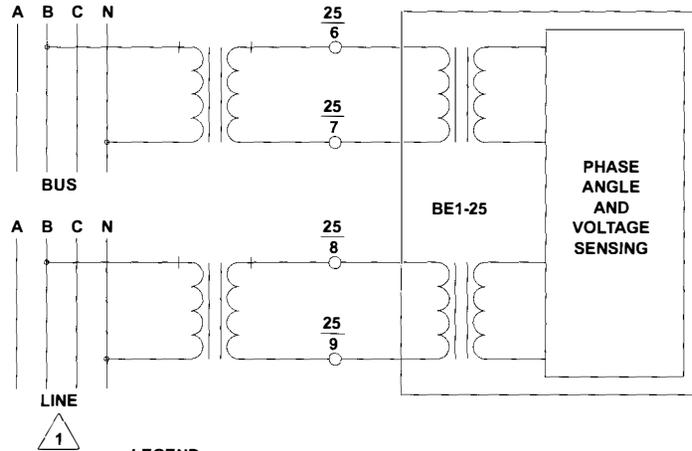
#### SHOCK

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

#### VIBRATION

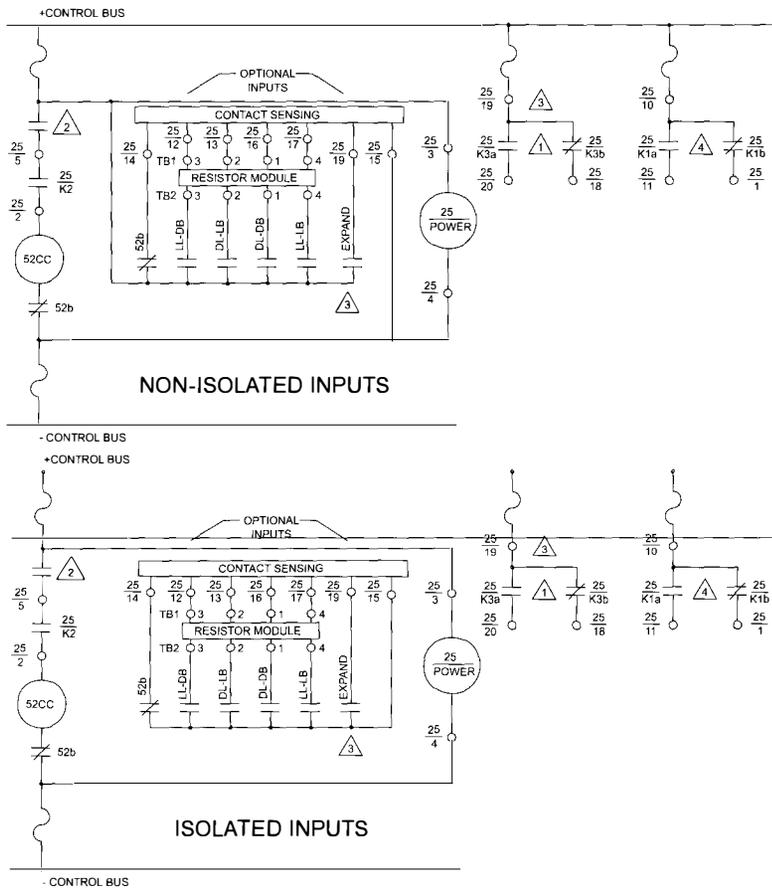
In standard tests, the relay has withstood 2g in each of three mutually perpendicular axes swept over the range of 10 to 500 Hz for a total of six sweeps, 15 minutes for each sweep, without structural damage or degradation of performance.

# CONNECTIONS



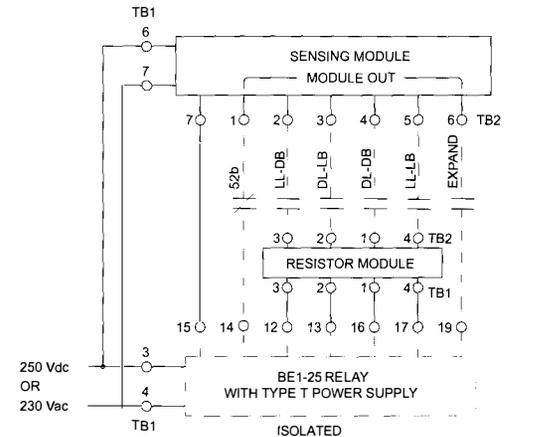
**LEGEND:**  
 25 SYNC-CHECK RELAY  
 1 SHOWN LINE-TO-NEUTRAL. COULD ALSO BE WIRED LINE-TO-LINE.

Figure 5 - Voltage and Phase Sensing



**LEGEND:**  
 25 SYNC-CHECK RELAY  
 25/K2 SYNC RELAY CONTACT  
 52CC BREAKER CLOSING COIL  
 52b BREAKER AUXILIARY CONTACT  
 FUSE  
 1 OPTIONAL AUXILIARY OUTPUT (NO, NC, OR SPDT) OR OPTIONAL POWER SUPPLY STATUS OUTPUT (NC ONLY) CONTACTS  
 2 SUPERVISORY OR AUTOMATIC BREAKER CLOSING CONTACTS  
 3 EXPAND OPTION AND AUXILIARY RELAY ARE MUTUALLY EXCLUSIVE  
 4 OPTIONAL VOLTAGE MONITOR RELAY

Figure 6 - Control Circuit Connections (Typical)



**LEGEND:**  
 52b BREAKER AUXILIARY CONTACT  
 LL-LB LIVE LINE-LIVE BUS  
 LL-DB LIVE LINE-DEAD BUS  
 DL-LB DEAD LINE-LIVE BUS

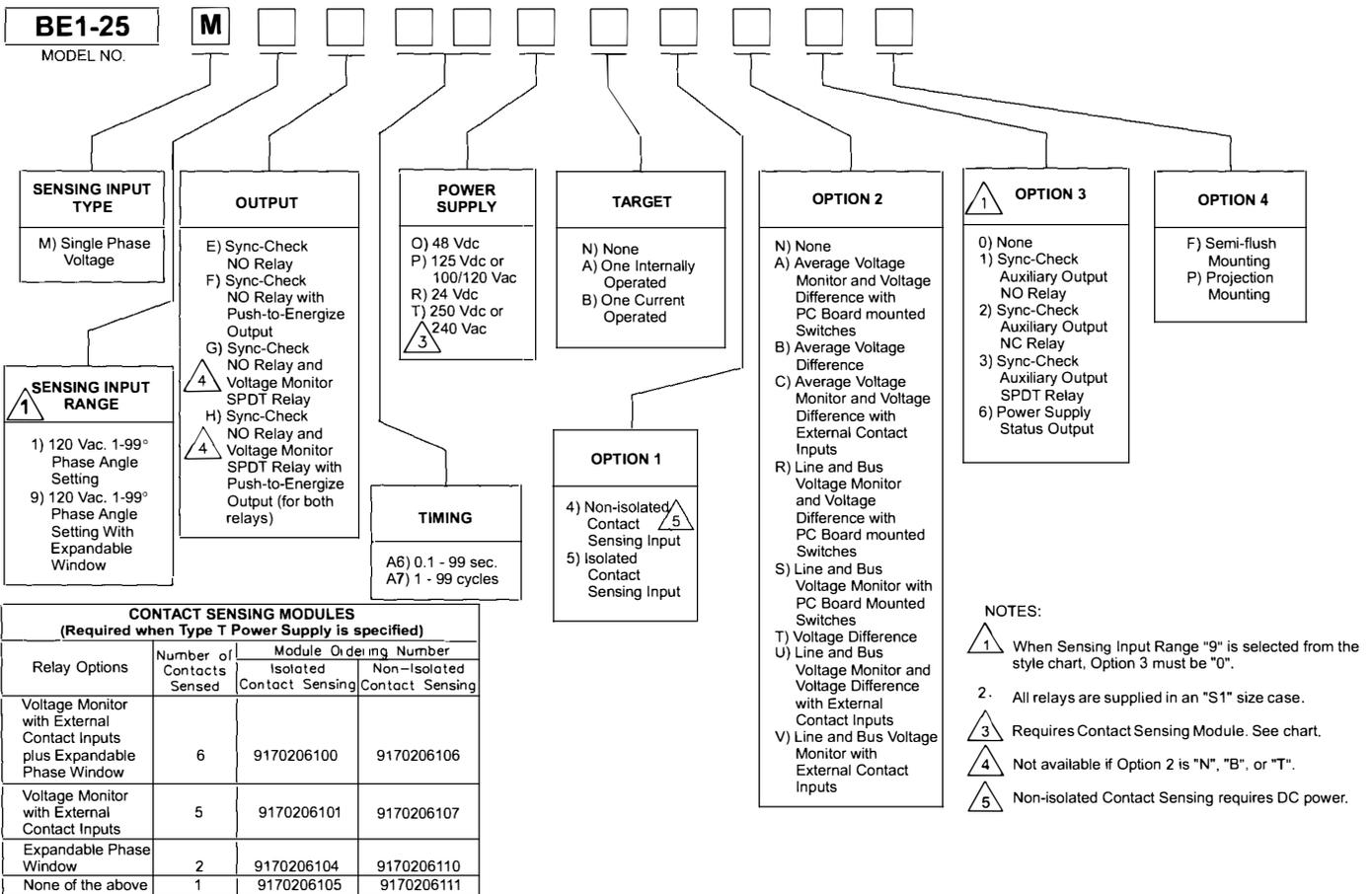
Figure 7 - Contact Sensing Using Modules (Only for Relays with Type T Power Supply)

# ORDERING

## SAMPLE STYLE NUMBER

The style number BE1-25M1EA6PN4R0F describes a BE1-25 Synch Check Relay having the following features:

- (M) - Sensing Input Type - Single-phase voltage
- (1) - Sensing Input Range - 120 Vac nominal 1-99° phase setting
- (E) - Output - Sync-check, NO
- (A6) - Timing - 0.1 to 99 seconds
- (P) - Power Supply - 125 Vdc or 100/120 Vac external power source
- (N) - Target - None
- (4) - Option 1 - Nonisolated contact sensing
- (R) - Option 2 - Line and bus voltage monitor with voltage difference, and PC board mounted switches
- (0) - Option 3 - None
- (F) - Option 4 - Semi-flush mounting



## STANDARD ACCESSORIES:

The following accessories are available for the BE1-25 Synch-Check Relay.

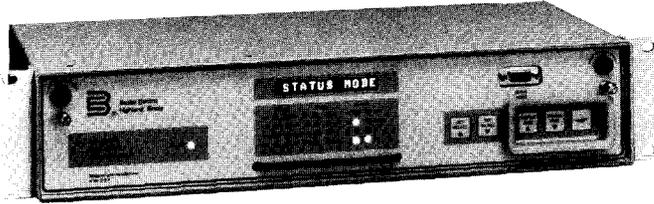
### Test Plug

To allow testing of the relay without removing system wiring, order two test plugs, Basler Electric part number 10095.

### Extender Board

The extender board permits troubleshooting of the printed circuit board outside of the relay cradle. Order Basler Electric part number 9165500100.





**BE1-25/79TR  
SYNC-CHECK  
RECLOSING RELAY  
(DRAWOUT 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.
- 19" rack mount case (vertical unit available).
- Occupies only 7.25 inches of space behind panel.
- Serial port communications for testing data collection and automated setting of parameters (front & rear).
- Single or three-phase voltage monitor

**ADDITIONAL INFORMATION**

**INSTRUCTION MANUAL**

Request Publication 9-2787-00-990

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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**

- Entire unit draws out for testing of the complete relay.

### **EASE OF USE**

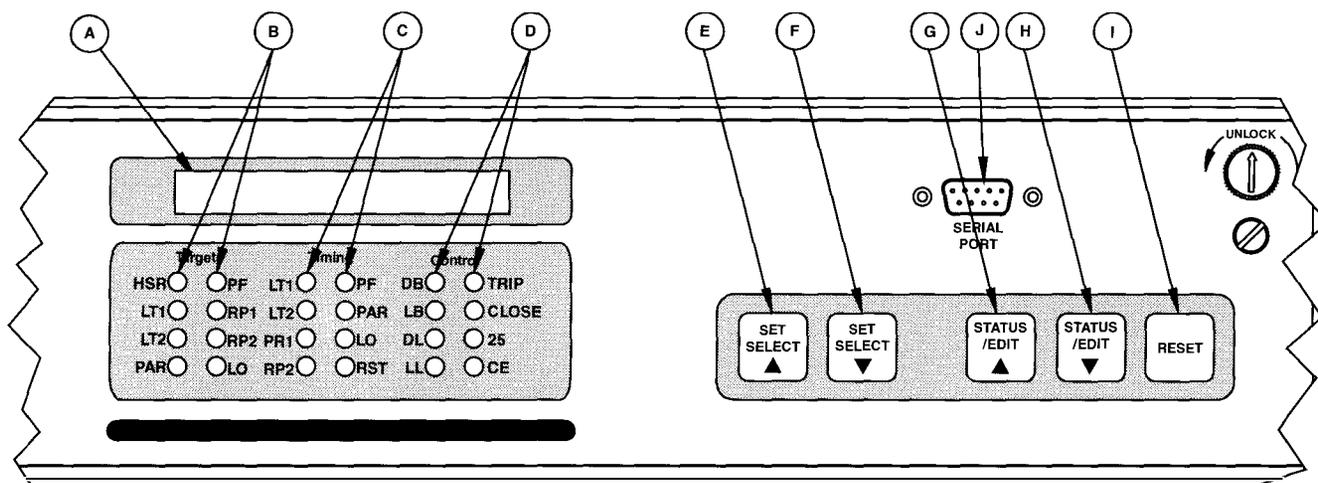
- Menu driven controls and bright LED display (figure 1).
- Three outputs may be programmed for any one of the following conditions:
  - Loss of Potential
  - Lockout
  - Parallel Memory
  - High-speed memory
  - Dead Bus-Dead Line
  - Dead Bus-Live Line
  - Live Bus-Dead Line
  - Live Bus-Live Line

### **COMMUNICATIONS**

- Menu-based system operates with readily available PC modem software that emulates a dumb terminal. Menu system is shown in Figure 2.

## FEATURES

(continued)



Locator	Control or Indicator	Function
A	Display	One line, twelve character display to monitor function status and settings.
B	Target LEDs	Eight LEDs (red). Seven LEDs (HSR, PF, LT1, RP1, LT2, RP2 and PAR) indicate associated reclosing output contacts have closed. One LED (LO) indicates relay is in lockout mode.
C	Timing LEDs	Eight LEDs (green). Seven LEDs (LT1, PF, LT2, PAR, RP1, LO and RP2) indicate associated timer is timing. One LED (RST) indicates relay is in reset mode.
D	Status and Control LEDs	Eight LEDs (yellow) indicate bus and line status and relay control functions.
E	Settings Select Up	Selects front panel display SETTINGS mode to show all settable parameters and scrolls up through the available settings.
F	Settings Select Down	Selects front panel display SETTINGS mode to show all settable parameters and scrolls down through the available settings.
G	Status/EDIT Up	Scrolls up the status parameters in the STATUS mode and raises the setting displayed on the front panel display while in the SETTINGS mode. Selects yes for specific decision presented on the front panel.
H	Status/EDIT Down	Scrolls down the status parameters in the STATUS mode and lowers the setting displayed on front panel display while in the SETTINGS mode. Selects no for specific decisions presented on the front panel display.
I	Reset Switch	Selects Status mode or Resets Targets display.
J	Port (Connector)	Front panel mounted receptacle for connecting RS 232 communications link.

Figure 1 - Controls and Indicators



# 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).

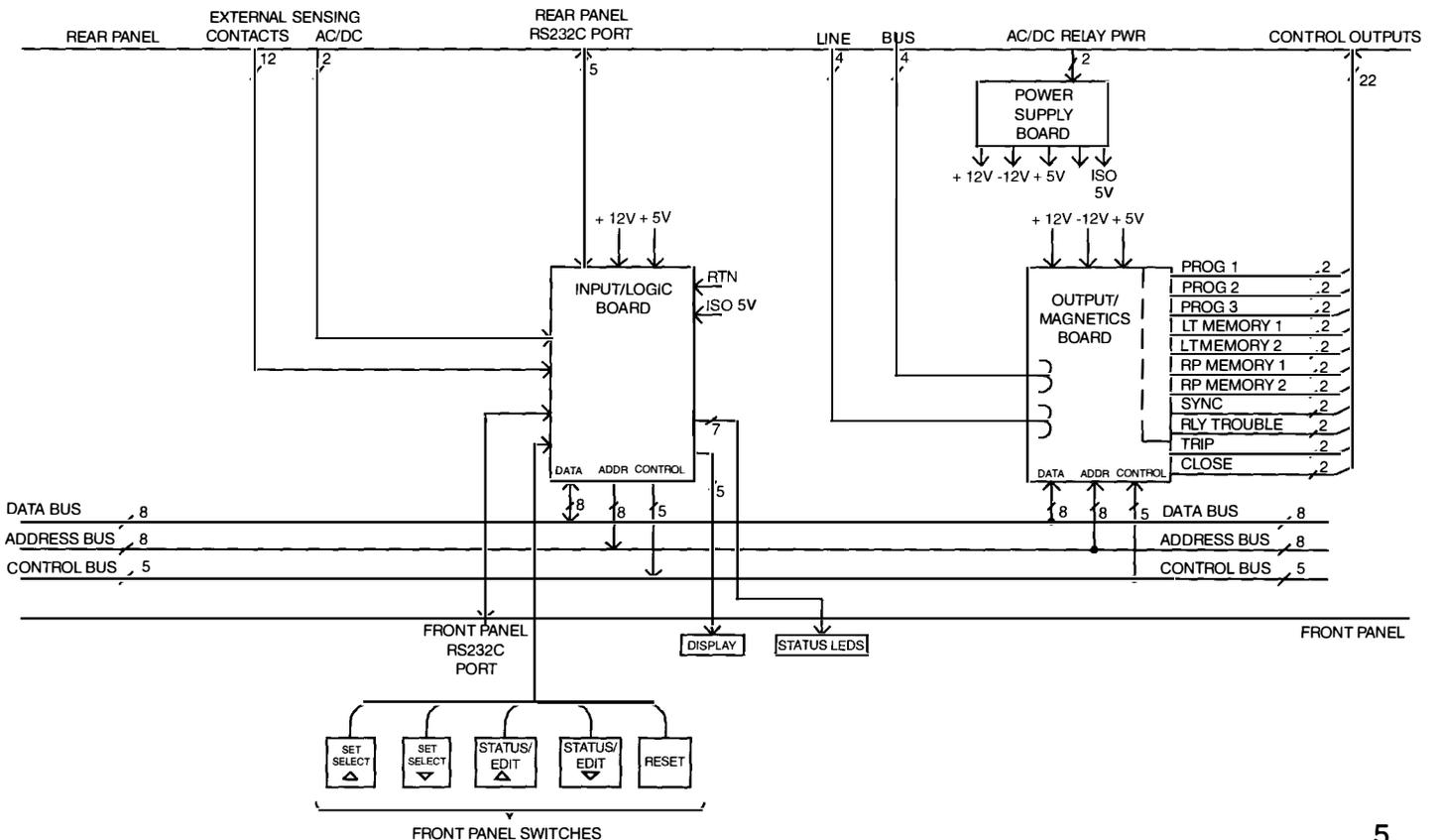
## CONTROL VIA EXTERNAL INPUTS

- 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)

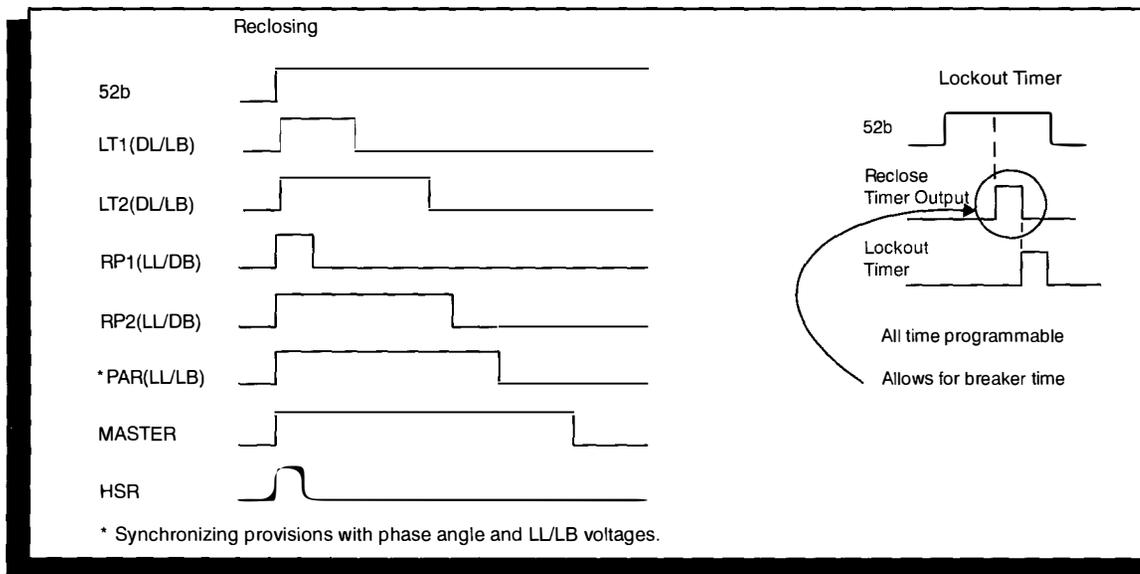
# FUNCTIONAL BLOCK DIAGRAM



## 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 LT1, LT2, RP1 and RP2. 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

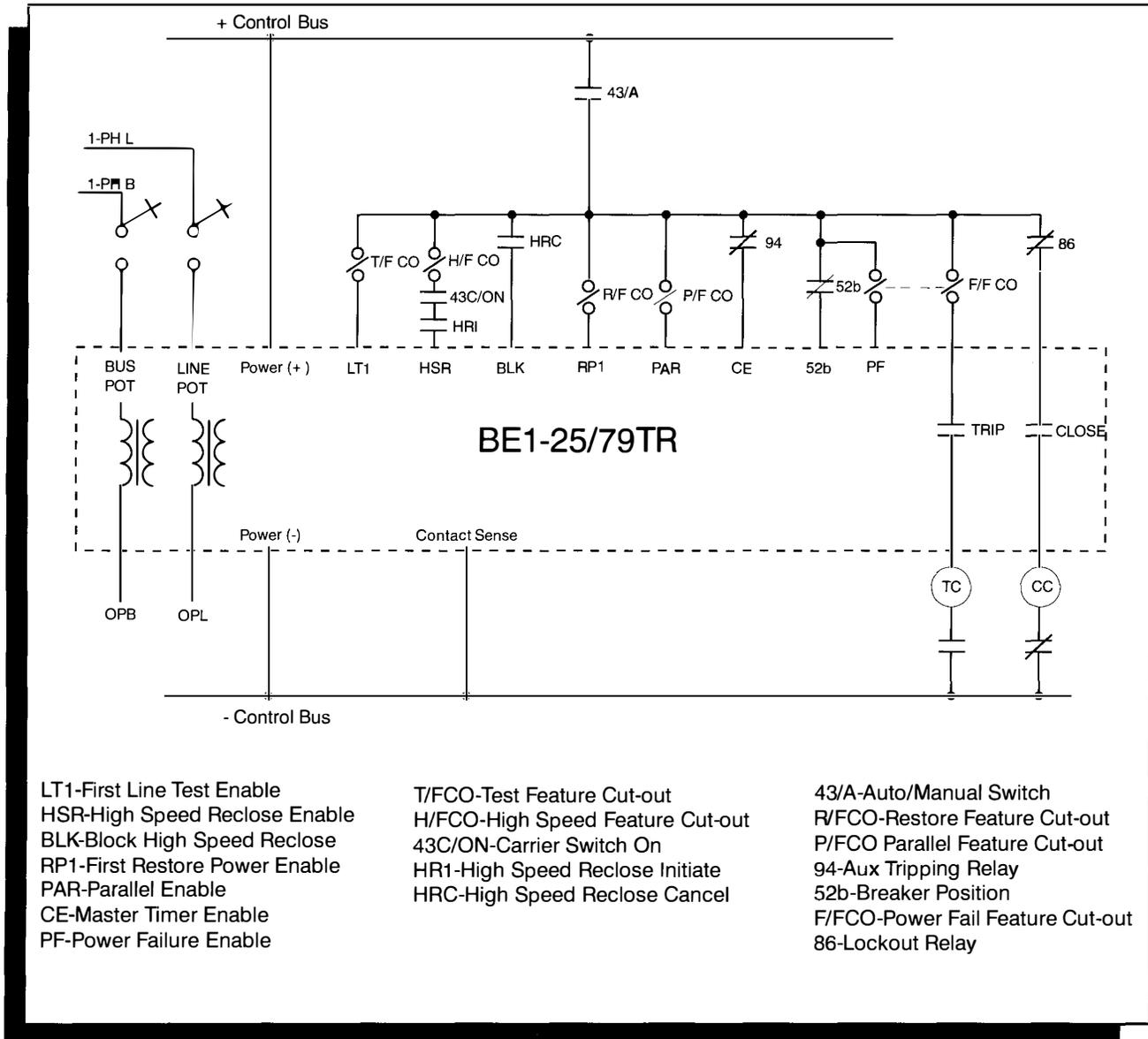
A form B output relay is provided for a trouble alarm. The contact is held open as long as the electronics receives proper operating voltages.

## 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)
- Two memory output relays for restore power (Form C).
- Two memory output relays for line test (Form C).
- One relay trouble alarm (Form B).
- Three programmable outputs.

## 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  $\pm 1.0$  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  $\pm 1.0$  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 <sup>△</sup>	Parallel (PAR)	1-999 seconds
1	Sync-check (SYNC)	1-999 cycles
1	High Speed Reclose (HSR)	1-99 cycles
1 <sup>△</sup>	Power Fail (PF)	1-99 seconds
2 <sup>△</sup>	Reset Time (RST1, RST2)	1-999 seconds
1	Lockout Time (LO)	1-999 seconds
1 <sup>△</sup>	Master Time (MASTER)	1-999 seconds
1	Close Output (Close TD)	1-999 seconds
1 <sup>△</sup>	Loss of Potential (LOP TD)	0.01-9.99 seconds
<p><sup>△</sup> 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.</p> <p><sup>△</sup> The power failure function is a tripping function and will not start the master timer.</p> <p><sup>△</sup> 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.</p> <p><sup>△</sup> 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.</p>		

## 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. Two relays are for line test and the other two are for restore power.

#### RT ALM

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

#### PROG

There are three N.O. programmable outputs available to indicate voltage monitor conditions, targets and alarms.

### 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).
- Live Bus (LB).
- Dead Line (DL).
- Live Line (LL).

### CONTROL

Four LEDs (yellow) indicate relay control status.

- Trip.
- Close.
- Sync-Check Function (25).
- 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 = 3.50 inches (2 rack units).  
Depth behind mounting surface = 7.75 inches.

## ORDERING

**ORDER BY MODEL NUMBER FROM THE TABLE BELOW.**

Part Number	Description
9 2787 00 100	3 phase, 125Vdc, Horizontal mount
9 2787 00 101	3 phase, 48Vdc, Horizontal mount
9 2787 00 102	3 phase, 125Vdc, Vertical mount
9 2787 00 103	3 phase, 48Vdc, Vertical mount
9 2787 00 104	1 phase, 125Vdc, Horizontal mount
9 2787 00 105	1 phase, 48Vdc, Horizontal mount
9 2787 00 106	1 phase, 125Vdc, Vertical mount
9 2787 00 107	1 phase, 48Vdc, Vertical mount
9 2787 00 200	3 phase, 125Vdc, Horizontal mount relay (9 2787 00 100) with LPTR Test box (9 2787 08 100)

### 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.

To order the test set, specify part number 9-2787-08-100.

### 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.



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