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Application Note

Basler BE1-79A RS Contact Function Provides Application Options

The BE1-79A Multiple Shot Reclosing Relay is an economical, microprocessor-based relay that automatically recloses circuit breakers that have been tripped by protective relays or other devices in power transmission and distribution systems. The BE1-79A offers true "plug and play" convenience; it can be installed in an existing GE type S2 case with no wiring changes required.

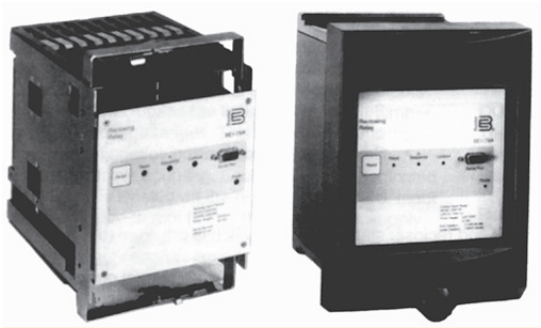

Figure 1 - BE1-79A Retrofit Reclosing Relay

Function of RS Contact

Figure 1 - The functionality of the RS contact in the BE1-79A relay emulates that of a GE ACR relay

The functionality of the RS contact in the BE1-79A emulates that of an ACR reclosing relay. The RS contact can be applied to disable the instantaneous trip circuit of protection relays after any close attempt typically leaving only time overcurrent protection in service. Also, it can be used to block transformer LTC changes during a reclosing sequence. For transmission line applications it has been used to permit operation of other automatic devices such as motor operated switches in line sectionalizing operations.

RS Contact Output State of Operation

Table 1: BE1-79A Reclosing Relay RS Contact Operation Table has various settings for the RS Contact Selection Switch, S5 (NO, NC) and the RS Contact Mode Setting (D, E) to illustrate operation of this element. Switch S5 can be selected manually as either normally open (NO) or normally closed (NC) to simulate the jumper selectable RS contact in an ACR relay. Independent of the Mode, the S5 NO/NC selection gives the state of the RS contact when the relay power supply is de-energized. The Mode

SP-79ARS Command: MODE,APPLY,REMOVE	S5 switch Position			RS Contact States:	
Mode D		**RS at Power Off**	**RS at Reset**	**RS at Apply Time**	**RS at Remove Time**
D, 0, 145	NC	Closed	Closed	Opens as soon as breaker 52/b makes	closes at 145 seconds
D, 2.5, 145	NC	Closed	Closed	Opens at 2.5 seconds	closes at 145 seconds
D, 0, 145	NO	Open	Open	Closes as soon as breaker 52/b makes	opens at 145 seconds
D, 2.5, 145	NO	Open	Open	Closes at 2.5 seconds	opens at 145 seconds
Mode E					
E, 0, 145	NC	Closed	Open	Closes as soon as breaker 52/b makes	Opens at 145 seconds
E, 55, 145	NC	Closed	Open	Closes at 55 seconds	Opens at 145 seconds
E, 0, 145	NO	Open	Closed	Opens as soon as breaker 52/b makes	Closes at 145 seconds
E, 55, 145	NO	Open	Closed	Opens at 55 seconds	Closes at 145 seconds

Mode D = RS element de-energized or "dropped out" when Power to 79A terminals 5 & 6 is ON

Mode E = RS element energized or "picked up" when Power to 79A terminals 5 & 6 is ON

NOTE 1: In the Energized Mode the RS contact functions opposite the way it does in the De-energized Mode and Power Off mode

NOTE 2: When either ac or dc operating power to terminal 5 or 6 is interrupted at any time during a reclose sequence, the RS contact returns to the 79A Power Off state until operating power is restored and the reclosing sequence is resumed.

Table 1 - BE1-79A Reclosing Relay RS Contact Operation Table

of the RS contact offers the ability to invert the relay logic. In the D(De-energized) Mode, the position of the RS contact will follow the classic definition of relay logic saying, "If RS logic is 0, the RS relay coil is de-energized, if RS logic is 1, the RS relay coil is energized." In the E (Energized) mode, the relay logic is inverted and the RS coil is normally energized and then de-energized when RS logic goes to 1. The effect is to say, "If RS logic is 0, the RS relay coil is energized, if RS logic is 1, the RS relay coil is de-energized." Note that if the E logic is selected, and the relay RS logic is 0, the RS coil will be energized, holding the output contact against its internal spring, but if the relay loses power at this point, the RS contact will change state to the open/closed position selected for switch S5. Table 1 is based on these explanations and will be referred to throughout the remainder of this note.

The 79A Power Off state of the RS contact element follows ac or dc operating power applied to terminals 5 and 6 of the 79A and whether switch S5 is in the NC (Normally Closed) position or NO (Normally Open) position. If operating power is not applied to terminals 5 and 6 and the Mode selected is D (De-energized) then the RS contact function as selected by S5, NC or NO is just as if you were measuring contact continuity across terminals 9 and 10 with the relay sitting on the test bench without any wiring connected. If the Mode is programmed for E (Energized), then operating power must be present at terminals 5 and 6 to hold the RS contact in its desired position at the 79A's Reset position.

RS Contact Settings

The RS Contact Setting Command, SP-79ARS determines the <mode>, <apply time>, and <remove time> of the RS contact. The syntax of the command is as follows:

SP-79ARS [=<mode>, <apply time>, <remove time>]

The mode setting indicates the state of the RS element when:

1. The relay has operating power applied to terminals 5 and 6
2. The 79A Relay is in Reset position with the RS contact Remove time expired

A Mode setting of D will de-energize the RS element during the conditions indicated above. A mode setting of E will energize the RS element for the conditions above. Apply Time set for zero is applied as soon as the circuit breaker 52/b contact makes. Apply Time set not zero begins its timing sequence as soon as the breaker opens on its first trip out and the 52/b contact makes. Remove Time also begins when the 52/b contact makes for the first time in a reclose sequence and lasts until its programmed Remove time is reached or the breaker successfully recloses and the 79A returns to its Reset position. Four different examples of RS contact configuration and settings are shown in *Figure 3: BE1-79A RS Contact Setting Examples* and explained below. (Note: If operating power is lost to terminals 5 or 6 of the relay during this time, the RS contact may change state as indicated in the Fig. 3 example and revert back to its energized state when power is restored.)

Mode D Example:

From Table 1 for Mode D settings, an NC RS contact (S5 = NC, mode = D) will be closed during 79A Power Off and will remain closed when the 79A relay is powered on (assuming the remove time from a previous reclose cycle has expired or the relay is in Reset). The NC contact will remain closed until a reclose cycle begins and the RS contact Apply Time is reached. The NC contact will then open and remain open until the RS contact Remove Time is reached.

When the Remove Time is reached, the NC contact will again close and remain closed until a new reclose cycle is begun. For the setting line D,0,145, as soon as the circuit breaker 52/b contact makes following the first trip the RS contact will open and remain open until a time of 145 seconds where it will again close. For setting D,2.5,145, the RS contact will remain closed for 2.5 seconds after the circuit breaker 52/b contact closes for the first trip out and then be open until the 145 second time is reached or Reset occurs as shown in Fig. 3, RS Example 1. If the 79A goes to Reset before the Remove Time is reached, the RS contact changes back to its state at Reset without having to time to the Remove Time set point.

From Table 1 for Mode D settings, an NO RS contact (S5 = NO, mode =D; Fig. 3, RS Example 2) will be open during 79A Power Off and will remain open when the 79A relay is powered on (assuming the Remove Time from a previous reclose cycle has expired or the relay is in Reset). The NO contact will remain open until the reclose cycle begins. At that time, the NO contact will continue to remain open until the RS contact Apply Time is reached. The NO contact will then close and remain closed until the RS contact Remove Time is reached.

Mode E Example:

From Table 1 for Mode E settings, an NC RS contact (S5 = NC, mode = E; Fig. 3, RS Example 3) will be closed during 79A Power Off and will be energized and opened when the 79A relay is powered on and in Reset position. The NC contact will remain open until the reclose cycle begins. At that time, the NC contact will continue to remain open until the RS Apply time is reached. The NC contact will then close and remain closed until the RS contact Remove Time is reached. When the Remove Time is reached or the 79A resets, the NC contact will again open and remain open until the next reclose cycle begins from the Reset position.

From Table 1 for Mode E settings, an NO RS contact selected (S5 = NO, mode = E; Fig. 3, RS Example 4) will be open during 79A Power Off and will be energized and closed when the 79A relay is powered on and in Reset position. The NO contact will remain closed until the reclose cycle begins. At that time, the NO contact will continue to remain closed until the RS Apply Time is reached. The NO contact will then open and remain open until the RS contact Remove Time is reached. When the Remove Time is reached or the 79A resets, the NO contact will again close and remain closed until the next reclose cycle begins from the Reset position.

RS Contact Example for Transformer LTC Blocking

SP-79ARS Mode Selection

If using the de-energized mode, and the Normally Closed RS contact (mode = D and S5=NC; Fig. 3, RS Example 1), be aware that the RS contact will revert to the de-energized state during loss of operating power to the 79A relay. Thus, if power is lost during the reclose cycle, the Normally Closed RS contact, S5=NC, being held Open to block the LTC will change state and remove the LTC blocking while the relay is without power. If a reliable dc power source to terminals 5 and 6 is available it will prevent this from occurring.

If using the energized mode, and the Normally Open RS contact (mode = E and S5=NO; Fig. 3, RS Example 4), the RS contact will revert to de-energized state during loss of power to the relay. If the power is lost during the reclose cycle, the NO RS contact being held open to block the

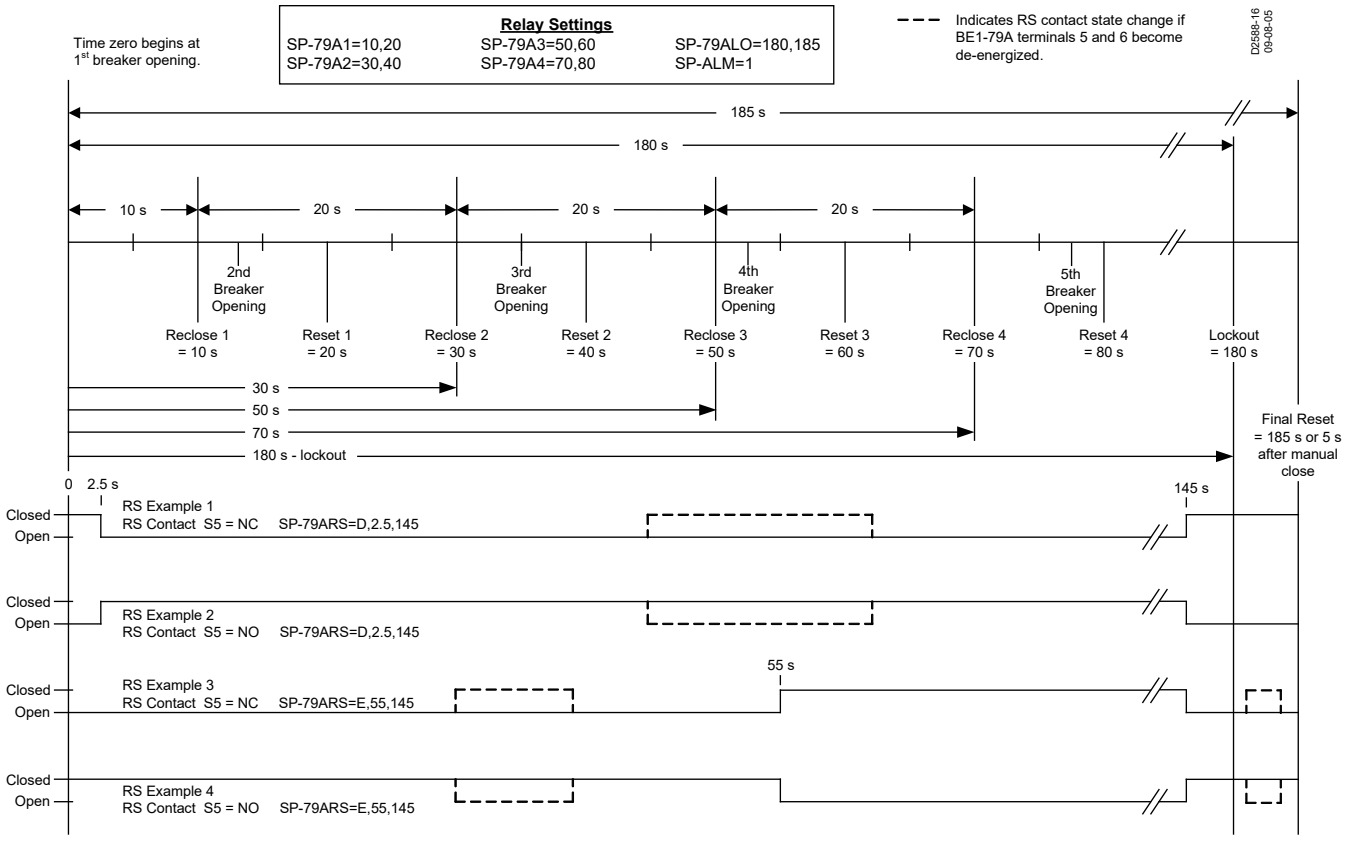

Figure 2 - BE1-79A RS Contact Setting Examples

LTC will remain open and continue the block. If the relay power to terminals 5 and 6 is lost at any other time (e.g., during breaker maintenance a common dc power may be turned off), the RS contact will change state, thus blocking the LTC, which may be undesirable under these circumstances. Awareness of this condition will allow the user to take the necessary steps to prevent this from happening.

SP-79ARS Remove Time Selection

The Remove Time of the RS contact, when used for LTC blocking, should be long enough to allow a complete reclose cycle to occur but should be set shorter than the final closures' Reset Time and before Lockout Time is reached. This ensures that the RS contact is blocking LTC operation during the reclose sequence but is reset to its normal condition before the next reclose cycle begins. The LTC will then be functioning normally even when the breaker has operated to Lockout condition.

RS Contact Example for Blocking Instantaneous Overcurrent Tripping

The 79A has the following settings with switch S5 set for NC, Normally Closed:

SP-79A1=0,10
SP-79A2=15,25
SP-79A3=45,55
SP-79A4=0,0
SP-79ALO=60,65
SP-79ARS=D,5,58
SP-ALM=2

With the NC 79A RS contact wired in series with an Instantaneous Overcurrent (device 50) trip circuit, it will open or block tripping of a circuit breaker by the 50 element five seconds after the first trip of the breaker. The 79A is programmed to close the breaker instantly for its first close, SP-79A1=0,10, and if the breaker trips a second time before the ten second Reset Time has expired, the 79A RS contact will open at the Apply time setting of five seconds and remain open until the Remove Time of 58 seconds from Time Zero is reached. This will permit the 50 element to be in service when the breaker is closed after Lockout.

If the breaker successfully closes on any of the three programmed close times with the third close at 45 seconds from the first trip and Resets, then the Remove Time also will be reset, restoring the RS contact to its original NC position and restoring the 50 element tripping for the next fault occurrence and trip-close sequence of the circuit breaker.

If the 50 element is to remain blocked when the 79A is in Lockout then the 79A RS Remove Time should be set for 65 seconds also. SP-79ARS=D,5,65.

For More Information

Most General Electric type ACR11 style reclosing relays can be directly replaced by the BE1-79A. The BE1-79A is also available in a Basler S1 case for new installations.

For further information, visit the download section of our website at www.basler.com to access product documentation on the BE1-79A and Application Notes on other topics.

To discuss your specific application, consult Basler at the factory at (618) 654-2341.

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