INSTRUCTION MANUAL

FOR

RECLOSING RELAY
BE1-79A

Part Number: 9310200114

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Ref. 94380002

INTRODUCTION

This instruction manual provides information about the operation and installation of the BE1-79A Reclosing Relay. To accomplish this, the following information is provided:

- General Information and Specifications
- Controls and Indicators
- Functional Description
- Installation
- Maintenance

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

First Printing: October 2011

Printed in USA

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March 2018

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.

REVISION HISTORY

The following information provides a historical summary of the changes made to this instruction manual (9310200893), application firmware, and hardware of the BE1-79A.

Manual Revision and Date	Change
D, 03/18	• Removed GOST-R certification from Section 1. • Minor text edits.
C, 09/14	• Corrected terminal numbering of Alt. Close 1 in Table 3-3. • Added Figure 3-4. • Added Storage statement in Section 5. • Corrected terminal numbering of 79A between REC 2 and 52 bb.
B, 04/12	• Replaced Figure 5-2.
A, 10/11	• Initial release

Application Firmware Version and Date	Change
1.07.00, 02/08	• Initial release

Hardware Revision and Date	Change
D, 05/13	• Improved functionality of the *Reset* pushbutton.
C, 11/11	• Initial release

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SECTION 1 • GENERAL INFORMATION

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SECTION 1 • GENERAL INFORMATION

Description

The BE1-79A 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 relay, part number 9310200114, offers "plug-and-play" convenience; it can be installed in an existing ABB FT-32 case with no wiring changes required for many applications. The BE1-79A relay, part number 9310200114, can replace the ABB type RC relay in most applications using 52a and 52b inputs. Refer to Section 3, *Functional Description,* to determine compatibility with your specific application.

Features

BE1-79A Multiple Shot Reclosing Relays have the following standard features:

- Rugged construction in a steel, draw-out case
- A maximum of four automatic reclosures
- A maximum of four automatic resets
- Lockout function
- Selectable instantaneous or delayed first reclosure
- Selectable internal or external instantaneous jumper
- Normally closed RS output contact
- Selectable contact sensing voltage range

Controls and Indicators

The front panel has indicators to verify relay power and recloser status. A Reset switch is provided to restore the relay to the reset mode by clearing a reclosing sequence or a lockout condition.

Communication

All relay settings are read or changed through the serial port located on the front panel. The BE1-79A uses ASCII protocol.

Primary Application

The BE1-79A automatically recloses circuit breakers that 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 BE1-79A 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 availability—decreases likelihood of permanent loss of line.

Specifications

BE1-79A relays have the following features and capabilities.

Reclose Timers 1, 2, 3, and 4

Range .... 0 to 300 seconds
Increments .... 0.1 second
Accuracy .... ±20 milliseconds ±1%, typical
                                                                                    ±50 milliseconds ±1%, maximum

Reset Timers 1, 2, 3, 4, and Final

Range .... 0 to 300 seconds
Increments .... 0.1 seconds
Accuracy .... ±20 milliseconds ±1%, typical
±50 milliseconds ±1%, maximum

Lockout Timer

Range .... 0 to 300 seconds
Increments .... 0.1 seconds
Accuracy .... ±20 milliseconds ±1%, typical
±50 milliseconds ±1%, maximum

RS Set and Reset Timers

Range .... 0 to 300 seconds
Increments .... 0.1 seconds
Accuracy .... ±20 milliseconds ±1%, typical
±50 milliseconds ±1%, maximum

Communication Port

Parameters .... 9600 baud, 8N1 half duplex
Protocol.. ASCII

Power Supply

Operating Range .... 120 to 240 Vac
125 to 250 Vdc

Contact Sensing Inputs

Operating Range

48 Vdc, Nominal .... 38.4 to 275 Vdc
125 Vdc/120 Vac, Nominal .... 100 to 275 Vdc, or 96 to 264 Vac
250 Vdc/240 Vac, Nominal .... 200 to 275 Vdc, or 192 to 264 Vac
Energizing Level .... 80% of nominal
Current Draw .... 1.5 mA maximum per input

Recognition Time

Typical .... 15 ms for dc, ac (45 to 65 Hz)
Maximum .... 25 ms for dc, ac (45-65 Hz)

Dropout Time

Typical .... 15 ms for dc, ac (45-65 Hz)
Maximum .... 25 ms for dc, ac (45-65 Hz)

Output Contacts

Resistive Ratings

120 Vac:.. Make, break, and carry 7 Aac continuously
250 Vdc:.. Make and carry 30 Adc for 0.2 s, carry 7 Adc
continuously, break 0.3 Adc

Inductive Ratings

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

Environment

Operating Temperature Range:........................... –40 to 70°C (–40 to 158°F)
Storage Temperature Range:.............................. –40 to 85°C (–40 to 185°F)

Humidity

Qualified to IEC 68-2-38, 1st Edition 1974, *Basic Environmental Test Procedures,* Part 2: *Test Z/AD: Composite Temperature Humidity Cyclic Test*

Type Tests

Electrostatic Discharge (ESD)

8 kV contact discharges and 15 kV air discharges applied in accordance with IEC 801-2 ESD.

Dielectric Strength

1,500 Vac at 50/60 Hz in accordance with IEEE C37.90. The RS-232 serial communication port is intended only for periodic use and is not subject to the requirements of IEEE C37.90.

Surge Withstand Capability—Oscillatory and Fast Transient

Qualified to IEEE C37.90.1-1989, *Standard Surge Withstand Capability (SWC) Tests for Protective Relays and Relay Systems.* The RS-232 Serial Communication Port is intended only for periodic use and is not subject to the requirements of IEEE C37.90.1.

Radio Frequency Interference (RFI)

Type tested using a 5 W, hand-held transceiver in the ranges of 144 and 440 MHz with the antenna placed within 6 inches (152 millimeters) of the relay.

Vibration

Energized

In standard tests, the relay has withstood 0.5 G in each of three mutually perpendicular planes, swept once over the range of 10 to 150 Hz, eight minutes each sweep, without structural damage or degradation of performance.

Non-Energized

In standard tests, the relay has withstood 1 G in each of three mutually perpendicular planes, swept over the range of 10 to 150 Hz for 20 sweeps, eight minutes each sweep, without structural damage or degradation of performance.

Shock

Energized

In standard tests, the relay has withstood 3 pulses at 5 G in each of three mutually perpendicular planes, 11 ms each pulse, without structural damage or degradation of performance.

Non-Energized

In standard tests, the relay has withstood 3 pulses at 15 G in each of three mutually perpendicular planes, 11 ms each pulse, without structural damage or degradation of performance.

Weight

6.3 lb (2.8 kg)

Maintenance

BE1-79A relays require no preventative maintenance. However, testing should be performed according to scheduled practices. If the relay fails to function properly, contact the Technical Support Services department of Basler Electric for a return authorization number before returning the relay for service.

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SECTION 2 • CONTROLS AND INDICATORS

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SECTION 2 • CONTROLS AND INDICATORS

Front Panel

Front panel controls and indicators are illustrated in Figure 2-1 and described in Table 2-1. The locators and descriptions of Table 2-1 correspond to the locators shown in Figure 2-1.
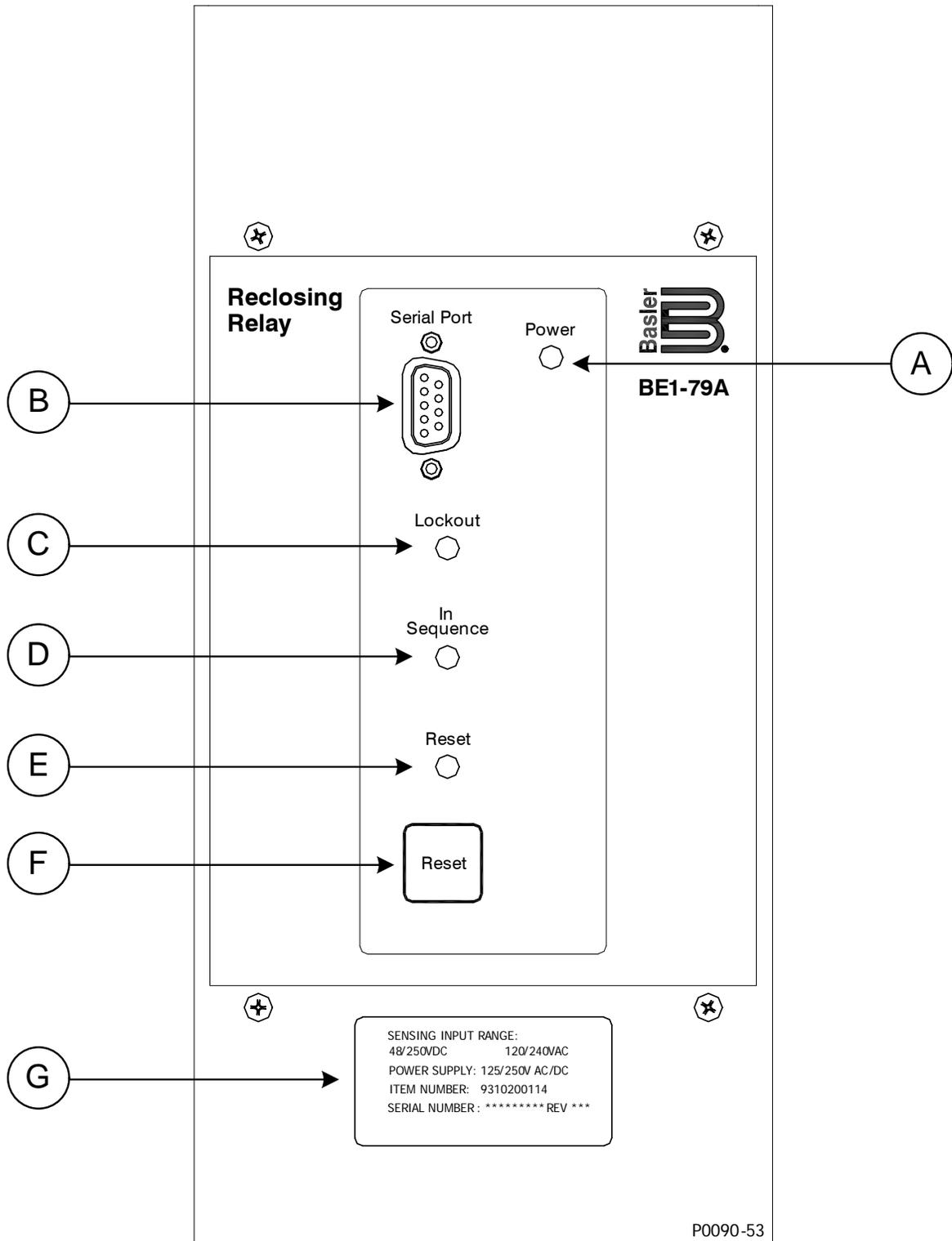

Figure 2-1. Front Panel Controls and Indicators

Table 2-1. Front Panel Control and Indicator Descriptions

Locator	Description
A	*Power LED.* A lit Power LED indicates that operating power is applied to the relay.
B	*RS-232 Serial Communication Port.* A PC or computer terminal running a terminal emulation program such as Windows® HyperTerminal can be connected to this port so that relay settings can be read or changed. Communication with the BE1-79A uses a simple ASCII command language.
C	*Lockout LED.* When lit, this LED indicates that the relay is in the lockout state.
D	*In Sequence LED.* A lit In Sequence LED indicates any one of the following states: • Timing to reclose • Timing to reset • Timing to lockout • Attempting to reclose • Attempting to reset
E	*Reset LED.* When lit, this LED indicates that the relay is in the reset state.
F	*Reset Pushbutton.* Pressing this momentary switch clears the In Sequence or Lockout LEDs and restores the relay to the reset state.
G	*Identification Label.* Shows relay information such as the sensing input range, power supply type, serial number, and part number.

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SECTION 3 • FUNCTIONAL DESCRIPTION

Introduction

BE1-79A relays are microprocessor-based devices that provide automatic reclosing of circuit breakers. This section describes the hardware, circuitry, and software of the BE1-79A.

Hardware

The BE1-79A is supplied as an FT-32 cradle without a case.

Circuit Operation

This description of circuit operation is divided into *Inputs*, *Microprocessor*, and *Outputs.* BE1-79A circuit functions are illustrated in Figure 3-1 and described in the following paragraphs.
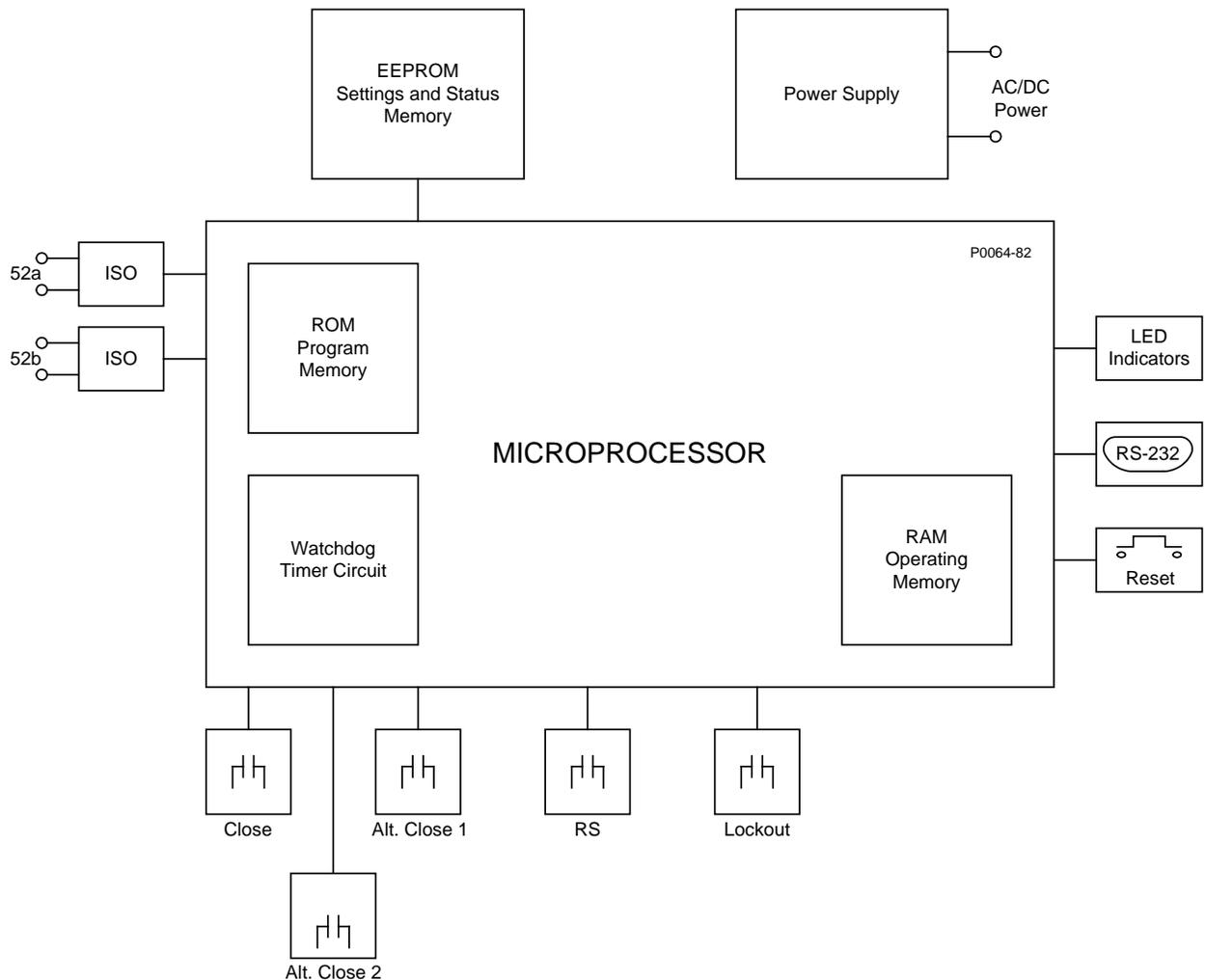
Figure 3-1. Function Block Diagram

Inputs

The four types of BE1-79A inputs are:

- Operating power
- Contact sensing inputs
- Reset switch
- Serial communication port

Operating Power

Operating power for the internal circuitry is applied to the internal, isolated, switching power supply. The power supply operates over a range of 120 to 240 Vac or 125 to 250 Vdc with no connection changes or jumpers required. The operating power input is not polarity sensitive and is not disrupted by variations in the supply voltage or frequency over the power supply operating range.

Contact Sensing Inputs

The contact sensing inputs are designated 52a and 52b. Each contact sensing input is rated for 48 to 250 Vdc and 120 to 240 Vac at 45 to 65 hertz.

Inputs can operate at any one of three jumper-selectable voltage ranges. Table 3-1 lists the nominal operating voltage for each of the three jumper positions. Jumpers P3, P4, and P5 should be set to the appropriate nominal voltage for the installed system. Jumper P6 is not used in this model. Instructions for placing each jumper in the desired position are provided in Section 5, *Installation and Configuration*. Input V5 is dedicated to monitoring the relay power supply input and is not jumper selectable.

Table 3-1. Contact Sensing Jumpers

Jumper Position	Nominal Voltage
1	125 Vdc or 120 Vac
2	48 Vdc
3	250 Vdc or 240 Vac

NOTE

In certain applications where 240 Vac control voltage is used, control circuit feedback can occur through system inductive coupling. This feedback can result in erroneous signals, causing relay operation. If there is potential for control circuit feedback, the jumper-selectable voltage range should be changed from the 48 Vdc, factory-default setting to a higher value. Selections are listed in Table 3-1.

The function of each input depends on the operating configuration of the relay. Tables 3-2 and 3-3 describe the function of each contact sensing input for each relay configuration. The GE nomenclature used for each input is provided in parenthesis following each description.

Table 3-2. Contact Sensing Inputs Description

Input	Terminals	Description
52a	5	Connect to a 52a contact. When voltage is present at this point at the point that the reset time is reached, or while the relay is in lockout, the relay will return to the full reset condition.
52b	4	Connects to a 52b contact. When in reset , voltage sensed at this input will result in the relay leaving reset and begin timing towards the first reclose. At the point of reaching the reclose time, a reclose output will occur if the 52b is still present. (See close output for description of anti-pump operation).

Reset Switch

This momentary-action switch clears the front-panel In Sequence or Lockout LEDs and restores the relay to a reset condition. The reset switch performs the same function as the manual clutch release on the ABB relay. Operating power must be applied to terminals 5 and 6 in order for a reset to occur.

Serial Communication Port

The communication port is a standard RS-232 (DB-9) female connector located on the front panel. This port provides the means to read and configure BE1-79A settings.

Microprocessor

All reclosing and communication functions are coordinated by the microprocessor. The BE1-79A uses an eight-bit microprocessor with integral ROM (read-only memory) and RAM (random access memory). The microprocessor is monitored by a watchdog circuit that resets the microprocessor if a problem is detected.

Outputs

The BE1-79A has 5 outputs. Table 3-3 provides a description of each output for each relay configuration.

Table 3-3. Outputs Description

Output	Terminals	Description
Close	12,13	This output closes when reclose times are reached , if 52b is still present. This contact will remain close for 3 seconds or until 52b inputs goes away. This contact will close only once for each timed reclose.
Alt. Close 1	15, 17	Operation is the same as close output.
Alt. Close 2	16, 17	Operation is the same as close output.
RS	1, 10	The SP-79RS command allows the RS contact operate and reset time to be programmed. Refer to Section 4, *Communication Commands, Command Descriptions,* for a detailed description of the SP-79RS command.
Lockout/Alarm	6, 7	The SP-ALM command is used to program the lockout output to function as a relay fail output or a combination relay fail/lockout output. As a relay fail output, the output will close if relay operating power is lost. The output will also close if the microprocessor detects an abnormal condition or when the microprocessor is unsuccessful at storing settings in EEPROM. If the microprocessor closes the output due to a failure, all three front panel LED indicators will be lit. The failure indication can be cleared by cycling operating power to the relay. Refer to Section 4, *Communication Commands, Command Descriptions,* for a detailed description of the SP-ALM command.

Fault Clearing

The BE1-79A allows the first reclose to be delayed slightly so that faults may de-ionize before a reclosure is initiated. Faults typically are allowed to de-ionize for approximately 217 ms (13 cycles) for distribution voltages and 300 ms (18 cycles) for transmission voltages (including breaker-operating time). The inherent delay of the BE1-79A relay is 22 to 48 ms when set at a time delay of zero. The reclose timers may be adjusted in increments of 0.1 seconds, which is 6 cycles on a 60 Hz system.

It is possible to set an ABB recloser for an instantaneous reclose with no voltage applied at terminals 5 and 6. If this unusual application is employed, the user must confirm that voltage is applied to BE1-79A terminals 5 and 6 when a reclose is desired. Terminals 5 and 6 must be energized for a reclose to be initiated.

Interconnections

Figure 3-2 illustrates the interconnection of the contact sensing inputs, relay outputs, and RS contact configuration switch in the BE1-79A relay. The state of all relay output contacts is shown with all power removed from the relay.

Figure 3-2. Relay Interconnections

Recloser Operation

Information about the software-controlled features of the recloser is provided in the following paragraphs.

Reset

A reclosing sequence may be initiated only when the relay is in the reset state. Reset is indicated by the front panel Reset LED. In order for the relay to reach reset, the controlled breaker must be closed, indicated by the presence of the 52a, during a three-second period when the reset timer expires. If the breaker opens prior to this time, the relay will proceed to the next reclosing attempt. If the number of programmed reclosing attempts has been exhausted, the relay will drive to lockout.

A reset time of zero is used if no reset is desired after a specific reclosing attempt. As an example, for a first reclose/reset time delay setting of SP-79A1=10,0, the 0 indicates that the BE1-79A will not reset until after the next non-zero reset time. If the second reclose/reset time delay setting is SP-79A2=30,40, then the relay will reset at the 40 second point in the timing sequence.

Lockout

Lockout, a state inhibiting relay operation, may be produced by four conditions:

- Reclose failure
- Number of breaker openings exceeds the number of programmed reclosure attempts
- The EXIT command is entered to terminate RS-232 communication
- Communication access has timed out

Lockout is indicated by the front panel Lockout LED. The S-ALM command allows output C3 to be programmed to close for a lockout condition. Lockout is terminated when the controlled breaker is closed (manually or by other means) and remains closed for the duration of the final reset time delay setting.

Reclosing Sequences

A reclosing sequence is initiated by the closure of a 52b contact. A reclosing sequence is indicated by the In Sequence LED located on the front panel. The BE1-79A provides up to four automatic reclosures. Each reclose setting is adjustable and has a setting range of 0 to 300 seconds. The number of reclosing attempts may be limited by adjusting any one of the reclose time delay settings (after the first reclose) to zero. When a breaker trip occurs at this point in the reclosing sequence, the BE1-79A will time toward lockout.

Each reclose and reset timer setting begins at time zero when the breaker opens the first time and initiates the first reclose timer. Typically, this makes the first reclose setting the shortest time setting and the fourth reclose setting the longest time setting. Figure 3-3 illustrates a BE1-79A reclosing sequence and the relationship of each reclose setting to the breaker openings.

The flow chart of Figure 3-4 is a simplified representation of reclosing sequence initiation and progression.

If a reclosing sequence is interrupted by removing power supply voltage from terminal 2 or 8, this will "freeze" the timing cycle at that point in the reclosing sequence. Freezing the timing sequence will result in contacts returning to their de-energized state when the BE1-79A power supply is de-energized. Once voltage is restored to the power supply, timing resumes from the point in the reclosing sequence that the power supply was de-energized.
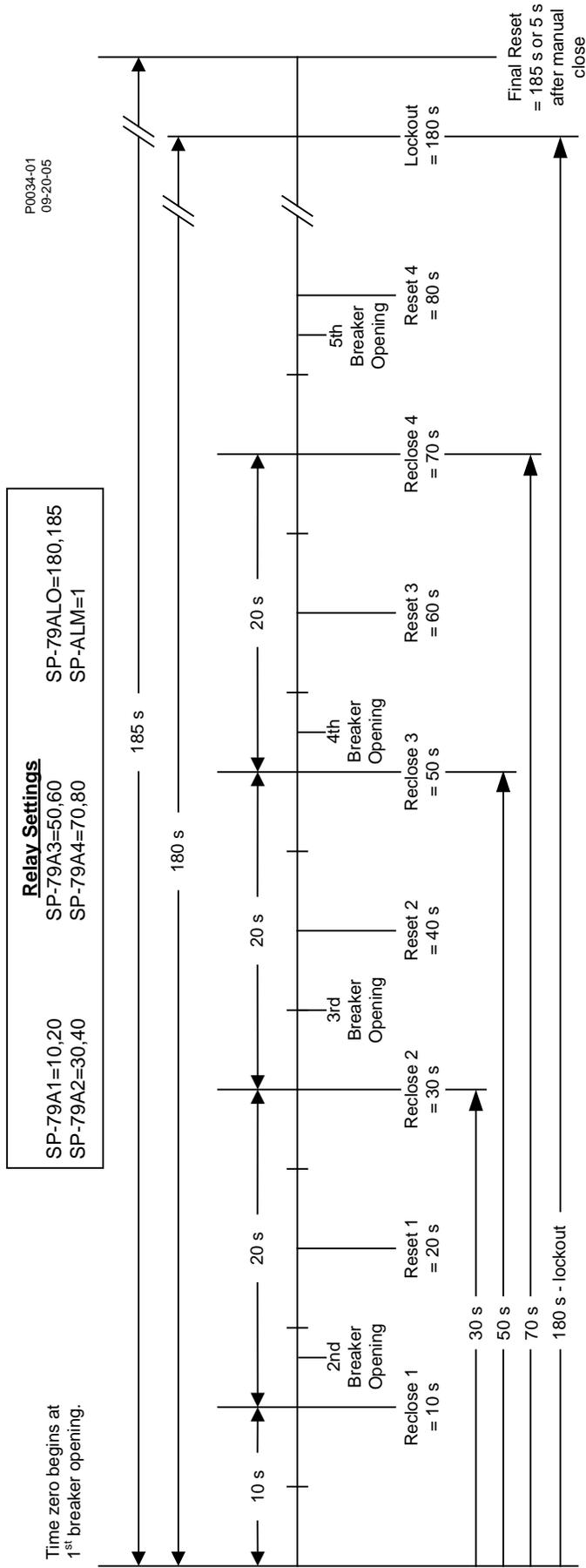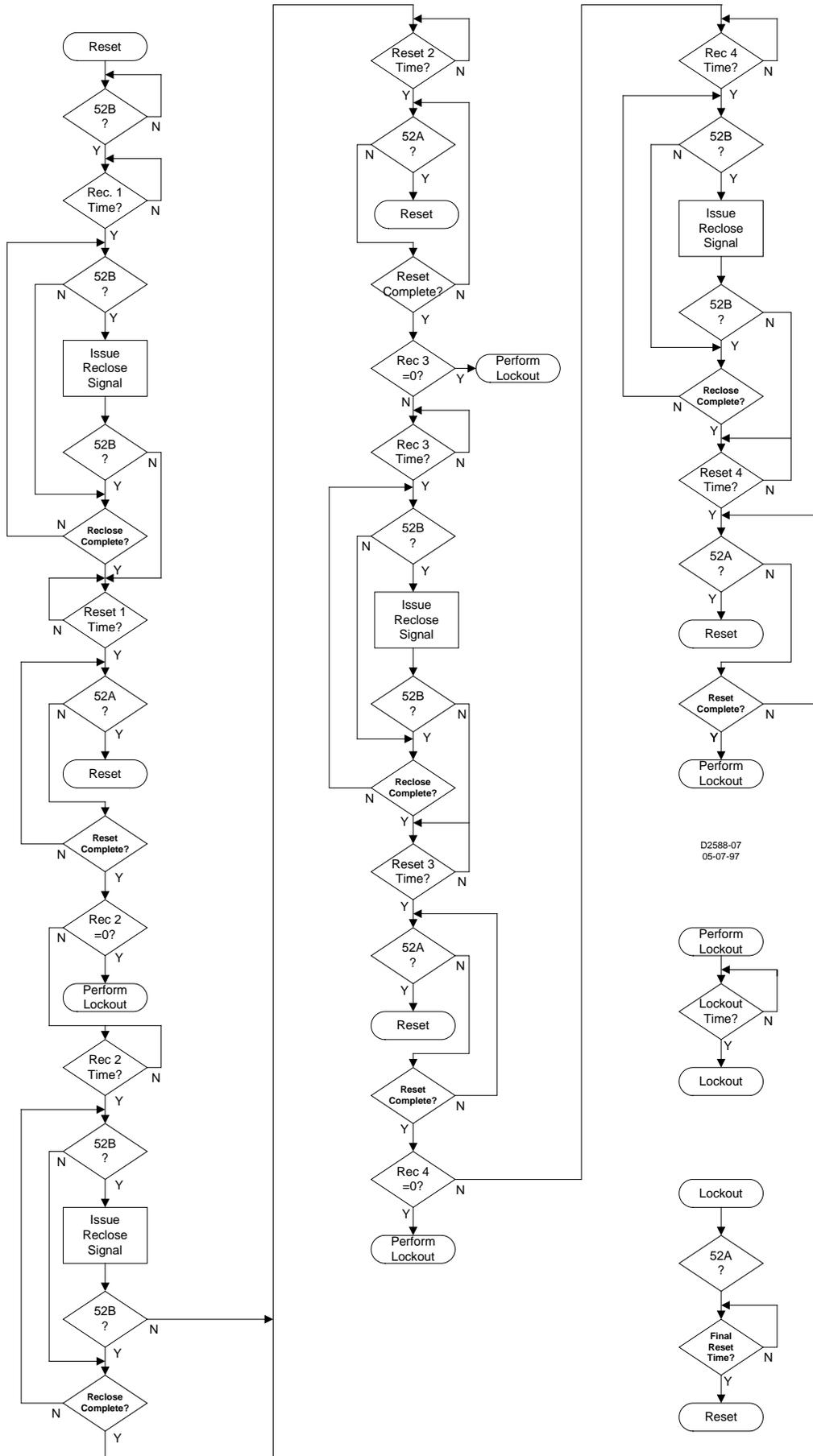
Figure 3-3. Reclose Settings Example

Figure 3-4. Reclosing Flow Chart

SECTION 4 • COMMUNICATION COMMANDS

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SECTION 4 • COMMUNICATION COMMANDS

Introduction

Communication commands are sent to the BE1-79A through a standard RS-232 (DB-9) connector located on the front panel. The BE1-79A ASCII communication protocol is compatible with readily available terminal/modem software such as the HyperTerminal application provided with the Windows® PC operating system. Information about configuring HyperTerminal and Terminal for communication with the BE1-79A is provided in Appendix B, *Terminal Communication*.

Communication Port Parameters

The following parameters apply to the BE1-79A communication port:

- Fixed baud rate of 9600
- Data bits fixed at 8
- Parity is fixed at NONE (N)
- Number of stop bits is fixed at 1
- Half duplex operation is supported

More information about BE1-79A communication interface requirements is provided in Section 5, *Installation and Configuration*.

ASCII Command Format

Each communication command, <CMD>, consists of an ASCII string terminated by a carriage return, <CR>. A line feed, <LF>, is optional.

Command Format

The BE1-79A uses a command format of <CMD>[<;>CMD…]<CR>[LF>]. Command components are defined as follows.

[ ]	Brackets identify optional parameters. The brackets are not part of the command.
< >	Separators are used for clarity. The separators are not part of the command.
CMD	<name>[n][<=><setting-x>…[<,><setting-x>]]

Where:

Name	Command name. Refer to *Command Descriptions* for more information.
N	Optional command object. If more than one object is available and n is omitted, the command applies to all objects.
=	Used to indicate that the command is to change data or settings.
Setting-x	Command setting(s)
,	Commas are used as setting separators
CR	A carriage return is used to end a command and start command execution.
LF	A line feed may be used for clarity. It is ignored by the relay.
Spaces	One or more spaces may be added between entries for clarity if desired.

Command Response Format

The BE1-79A uses a command response format of [<response>][<ACK>]. Command components are defined as follows.

response	Determined by CMD.
ACK	">" is returned for a valid command, "?" is returned for an invalid command.

Commands received by the BE1-79A consist of two types: requests for information and changes to operating parameters. Commands to change parameters are identified by and equal sign (=). The operating parameters to the right of the equal sign are intended to replace the current operating parameters related to the command.

Some commands may pertain to multiple items. In that case, a numeric identifier is used after the command name to specify a single item. If the identifier is omitted, the command is applied to all possible items. For

example, the SP-79A1 command could be used to read the first reclose setting or the command S could be used to read all reclose settings.

Command Descriptions

BE1-79A command descriptions and examples are provided in the following paragraphs.

Changing Settings through the Serial Port

The ACCESS command is used to access write privileges while changing relay settings. Relay control functions are disabled when access is granted. Changing the settings through the serial port requires that the operator use the ACCESS command to obtain programming access. The operator enters ACCESS= and the relay responds with an acknowledgement of ACCESS GRANTED if the command was received and executed. Any time an invalid command is received, the relay will respond with a question mark (?).

The EXIT command is used to release write privileges while changing relay settings. After the changes are made, the new data will be copied to the working settings and saved to nonvolatile memory when EXIT is entered. The operator must confirm that the programming is completed and accepted before the changes are actually made. It is important to make all changes to relay settings before executing the EXIT command. This ensures that all intended settings are executed. The relay will go to the lockout state after the EXIT command is entered. If voltage is sensed at V1, the relay will return to the reset state after the lockout timer expires.

Changing settings through the serial port consists of the following sequence:

1. Enter ACCESS=<CR> or A=<CR>.
2. Enter the necessary commands to change the current settings.
3. Enter EXIT<CR> or E<CR> to clear access and save settings.
4. Enter Y (yes)<CR> to confirm save. Enter N (no) to continue using the old settings.

The <CR> characters placed after commands represent a carriage return or pressing the Enter key. For simplicity, they will no longer be shown. However, each line entered by the operator must be terminated with a carriage return <CR> or a carriage return–line feed <CR–LF>.

Access Command

ACCESS Command

Purpose: Read/set programming access in order to change user settings.
Syntax: ACCESS[=] or A[=]

Access must be changed by entering ACCESS= before any changes to the settings can be made. Relay protection functions are disabled when access is granted. The ACCESS command is valid for a period of five minutes if no new characters are entered. ACCESS by itself may be used to check if programming access is active or disabled. The relay will respond with ACCESS GRANTED or ACCESS: NO. The available access privilege is Privilege S: Setting Access. When exiting programming access, the relay will go to the lockout state after the EXIT command is entered. If voltage is sensed at V1, the relay will return to the reset state after the lockout timer expires.

Exit Command

EXIT Command

Purpose: Exit programming mode
Syntax: EXIT or E
Comments: Exits the programming mode and resets the programming access privilege to 0.

Changes are made to a scratchpad copy of the settings. After the changes are made, the new data will be saved to nonvolatile memory and the new, working settings will be initialized when control to make changes is released by entering the EXIT command. After entering EXIT, the user is prompted to confirm that the new data should be saved. The user has three options (Y or N or C). If Y is entered, the data will be saved. If N is entered, the changes will be cleared and the old settings will be restored. If C is entered, the EXIT command will be aborted and programming may continue. It is important to make all changes to relay parameters before executing the EXIT command. This ensures that all intended settings are executed.

For clarity in the examples, relay responses are printed in the `Courier` typeface.

EXIT command example: exit after making setting changes.

EXIT
```
>SAVE CHANGES (Y/N/C)?          Prompt to save (Y)es, discard changes (N)o, or (C)ontinue
>Y                             Confirmation to save changes
CHANGES SAVED                  Confirmation that changes were saved
```

Obtaining Help Information Through the Serial Port

The HELP or H command provides general help information on command syntax and functionality when the manual is not available. Help is available only when the relay is in a reset state.

HELP Command

Purpose: Obtains help on using serial port commands.
Syntax: HELP or H
Comments: The HELP command returns a listing of all available commands along with the proper syntax for each command.

Obtaining a Summary of All Settings

All relay settings may be listed using the S command.

S Command

Purpose: Read all relay settings back to user.
Syntax: SP-79A[n]
Comments: S by itself may be used to read all relay settings. SP-79A[n] is used to read a specific setting. the S command can be used to make a record of the relay settings after they have been set.

S command example: Obtain a report of the relay settings.

A=
S
```
SP-79A1 5,10
SP-79A2 15,20
SP-79A3 25,30
SP-79A4 35,40
SP-79ALO 45,50
SP-79ARS D,0,5
SP-ALM 2
>
```

Reclose and Reset Timer Setting Command

SP-79A Command

Purpose: Read or change the reclose and reset timer settings.
Syntax: S[-79a[n][=<reclose time delay>,<reset time delay>]
Comments: n: reclose number of LO for lockout. See Table 4-1 for setting defaults.

reclose time delay: adjustable from 0 to 300 seconds in 0.1 second steps. A Reclose 1 setting of zero will cause an instantaneous first reclosure. A setting of zero for any other reclose time delay disables the reclose shot and subsequent shots.

reset time delay: adjustable from 0 to 300 seconds in 0.1 second steps. A reset time delay setting of zero will cause the reset to be disabled. A reset time delay setting less than the reclose time setting will cause an immediate reset following the reclose attempt.

SP-79A command example: Read the second reclose and reset timer settings.

A=
SP-79A2
```
15.0,20.0
>
```

Lockout Timer Setting Command

SP-79ALO Command

Purpose:	Read or change the lockout timer settings.
Syntax:	SP-79ALO[=<lockout time delay>,<final reset time delay>]
Comments:	lockout time delay: adjustable from 0 to 300 seconds in 0.1 second increments. A lockout time delay setting of zero will cause an instantaneous lockout when the breaker opens. A lockout time delay setting that is shorter than a reclose time delay setting will take priority and drive the relay to lockout.

Final reset time delay: adjustable from 0 to 300 seconds in 0.1 second increments. A final reset time delay that is equal to zero or is less than the lockout time delay setting will give an immediate reset following lockout and a manual reclose. See Table 4-1 for setting defaults.

Table 4-1. Internal Default Settings

Command	Default
SP-79A1	0.0,0.0
SP-79A2	0.0,0.0
SP-79A3	0.0,0.0
SP-79A4	0.0,0.0
SP-79ALO	0.0,15.0
SP-79ARS	E,1.5,15.0
SP-ALM	2

RS Contact Setting Command

SP-79ARS Command

Purpose:	Read or change the RS contact settings.
Syntax:	SP-79ARS[=<mode>,<apply time>,<remove time>]
Comments:	mode: the state of the RS coil and contact, which can be D or E for the coil status.

   D: de-energized RS coil. Second NO contact when terminals 5 and 6 are de-energized.
   E: energized RS coil. Second NC contact when terminals 5 and 6 are energized.

apply time: time from the start of the reclose cycle until the RS contact is applied. The apply time is adjustable from 0 to 300 seconds in 0.1 second increments.

remove time: time from the start of the reclose cycle until the RS contact is removed. The remove time is adjustable from 0 to 300 seconds in 0.1 second increments. See Table 4-1 for setting defaults.

Refer to Appendix A for SP-79ARS command examples.

Alarm Output Command

SP-ALM Command

Purpose:	Read or change the Lockout/Relay Fail output setting.
Syntax:	SP-ALM[=<mode>]
Comments:	mode: selects the operating mode of the alarm output, which can be 1 or 2.

   1 selects Relay Fail
   2 selects Relay Fail and Lockout (default setting)

Relay Information Command

RG-VER Command

Purpose:	Read information about relay hardware/firmware configuration
Syntax:	RG-VER
Comments:	Transmitting the RG-VER command will cause the relay to respond with the relay model number and the firmware version and date.

SECTION 5 • INSTALLATION AND CONFIGURATION

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SECTION 5 • INSTALLATION AND CONFIGURATION

General

BE1-79A Reclosing Relays are delivered in sturdy cartons to prevent shipping damage. Upon receipt of a relay, check the model number against the requisition and packing list for agreement. Inspect for damage and, if there is evidence of such, file a claim with the carrier and notify the Basler Electric regional sales office, your sales representative, or the Technical Sales Support department of Basler Electric.

If the relay is not installed immediately, store it in the original shipping carton in a moisture- and dust-free environment.

Storage

This device contains long-life aluminum electrolytic capacitors. For devices that are not in service (spares in storage), the life of these capacitors can be maximized by energizing the device for 30 minutes once per year.

Mounting

Because the BE1-79A is of solid-state design, it does not have to be mounted vertically. Any convenient mounting angle may be chosen. The BE1-79A is available in an FT-32 cradle that is intended for installation in an existing FT-32 case.

Connections

Incorrect wiring may result in damage to the relay. Be sure to use the correct input power for the power supply and the correct input voltage for the contact inputs. Connections should be made with a minimum wire size of 14 AWG. Figure 5-1 provides a typical connection diagram for an AC application. Figure 5-2 provides a typical connection diagram for a DC application.

Application

The intended function of the BE1-79A Reclosing Relay is to duplicate an ABB recloser with only minor variations. To ensure that your BE1-79A relay functions properly, you should consider the adjustments and settings described in the following paragraphs.
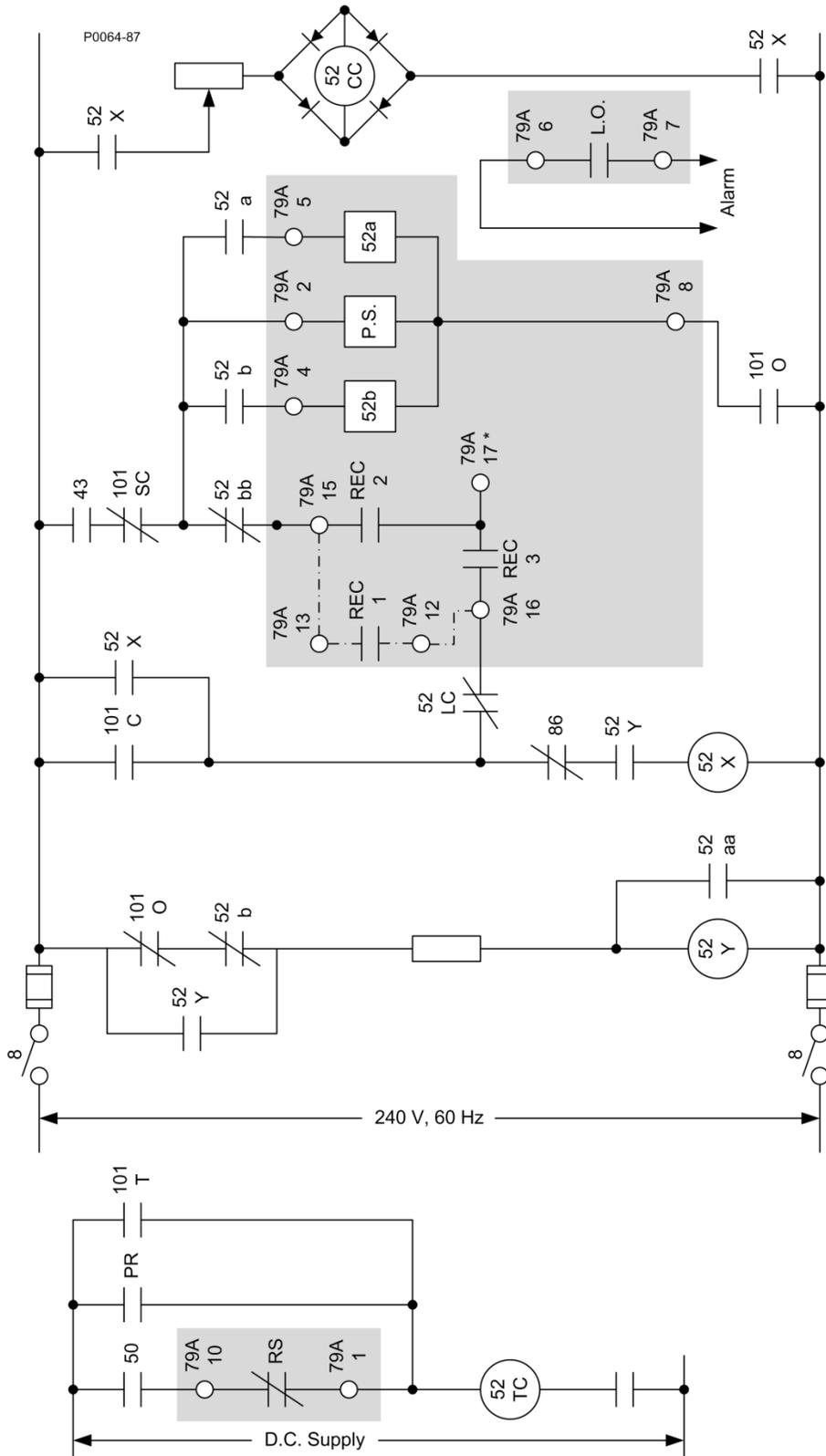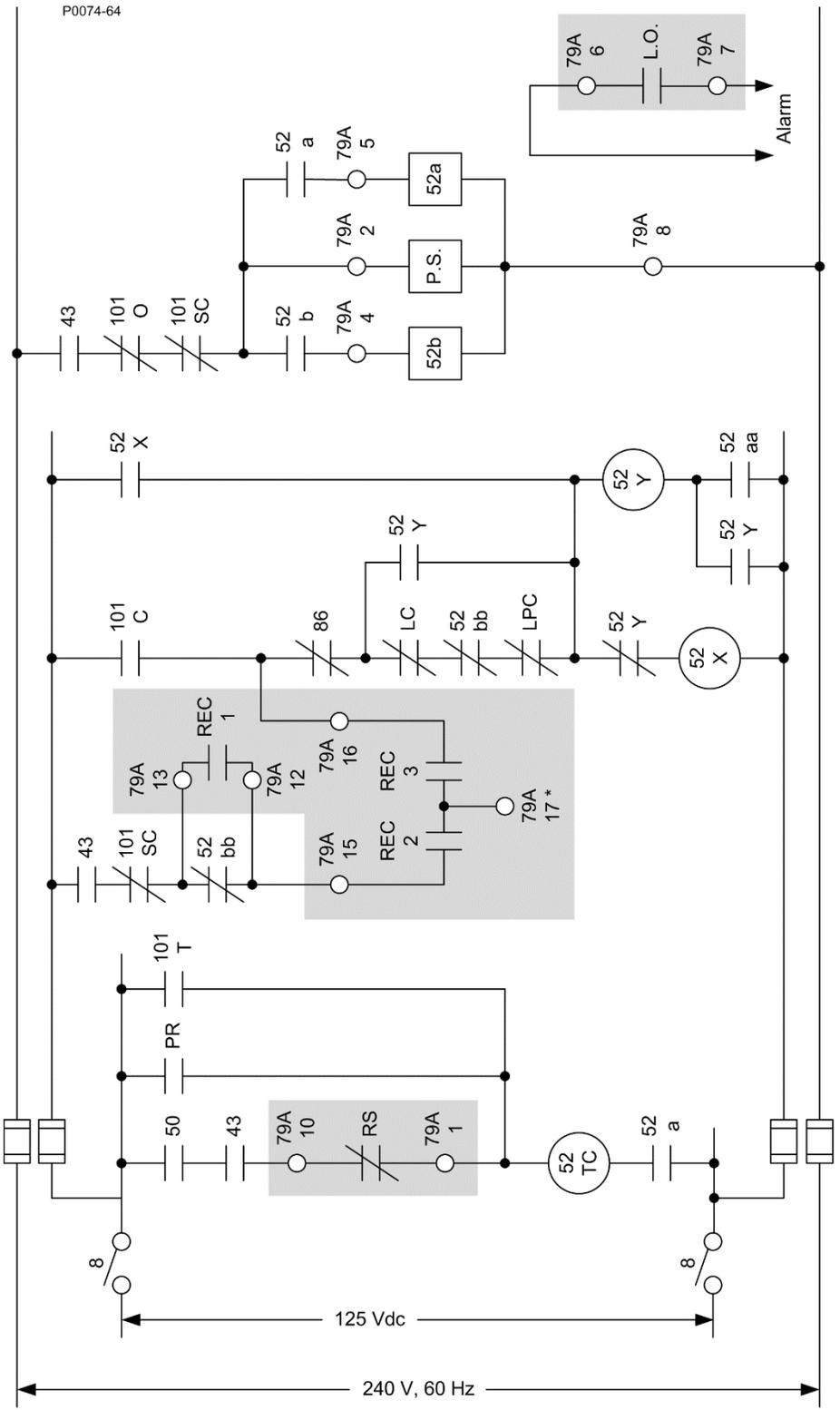
Figure 5-1. Typical AC Application Connections

PR - PROTECTIVE RELAY
8 - CONTROL POWER SWITCH
43 - AUTOMATIC OPERATION CUTOUT SWITCH
50 - INSTANTANEOUS TRIP UNIT
52a - OIL CIRCUIT BREAKER AUXILIARY SWITCH OPEN WHEN BREAKER IS OPEN
52b - OIL CIRCUIT BREAKER AUXILIARY SWITCH CLOSED WHEN BREAKER IS OPEN
52aa - OIL CIRCUIT BREAKER MECHANICAL SWITCH CLOSED IN OPERATE POSITION
52bb - OIL CIRCUIT BREAKER MECHANICAL SWITCH OPEN IN OPERATE POSITION
101 - CONTROL SWITCH
52LC - LATCH CHECK SWITCH
52TC - OIL CIRCUIT BREAKER TRIP COIL
52X - CONTROL RELAY
52Y - CUTOFF RELAY
86 - LOCKOUT RELAY

- - - · - - - For reclosure through independent contacts (and not instantaneous), make dotted connections as shown between terminals 79A-13/15 and 79A-12/16, and open connection to terminal 79A-16.

* For selective instantaneous reclosing.

Figure 5-2. Typical DC Application Connections

PR - PROTECTIVE RELAY
8 - CONTROL POWER SWITCH
43 - AUTOMATIC OPERATION CUTOUT SWITCH
50 - INSTANTANEOUS TRIP UNIT
52a - OIL CIRCUIT BREAKER AUXILIARY SWITCH OPEN WHEN BREAKER IS OPEN
52b - OIL CIRCUIT BREAKER AUXILIARY SWITCH CLOSED WHEN BREAKER IS OPEN
52aa - OIL CIRCUIT BREAKER MECHANICAL SWITCH CLOSED IN OPERATE POSITION
52bb - OIL CIRCUIT BREAKER MECHANICAL SWITCH OPEN IN OPERATE POSITION
101 - CONTROL SWITCH
52LC - LATCH CHECK SWITCH
52TC - OIL CIRCUIT BREAKER TRIP COIL
52X - CONTROL RELAY
52Y - CUTOFF RELAY
86 - LOCKOUT RELAY

* For selective instantaneous reclosing.

Motor Voltage

No adjustment is required for the voltage applied at terminals 2 and 8. The applied voltage can range from 120 to 240 Vac or 125 to 250 Vdc. These terminals serve as the input to the BE1-79A power supply.

Contact Sensing Inputs

Energizing levels for contact sensing inputs and internal control voltages are jumper selectable for operation at three nominal voltage levels. Jumpers P3, P4, and P5 should be set to the appropriate system nominal voltage. P6 is not used in this model. Nominal voltage levels of 125 Vdc/120 Vac, 48 Vdc, or 250 Vdc/240 Vac may be selected.

NOTE

In certain applications where 240 Vac control voltage is used, control circuit feedback can occur through system inductive coupling. This feedback can result in erroneous signals, causing relay operation. If there is a potential for control circuit feedback, the jumper selectable voltage range should be changed from the 48 Vdc factory default setting to a higher position. Selections are provided in Table 3-1.

The following paragraphs describe how to locate and change the position of the contact-sensing jumpers.

1. The jumper terminal blocks are accessible through an opening on the left-hand side of the relay. Locate the three jumper terminal blocks (P3 through P5). Jumper terminal block P6 is not used in this model. Each terminal block has three pins and each jumper is factory installed on pins 2 and 3. Figure 5-3 illustrates contact sensing jumper locations and positions.

2. To select operation at 125 Vdc or 120 Vac, remove the jumper from pins 2 and 3 and position it on pins 1 and 2. To select operation at 250 Vdc or 240 Vac, remove the jumper from pins 2 and 3 and position it on pin 3 for storage. (Only pin 3 of the terminal block should be covered.)
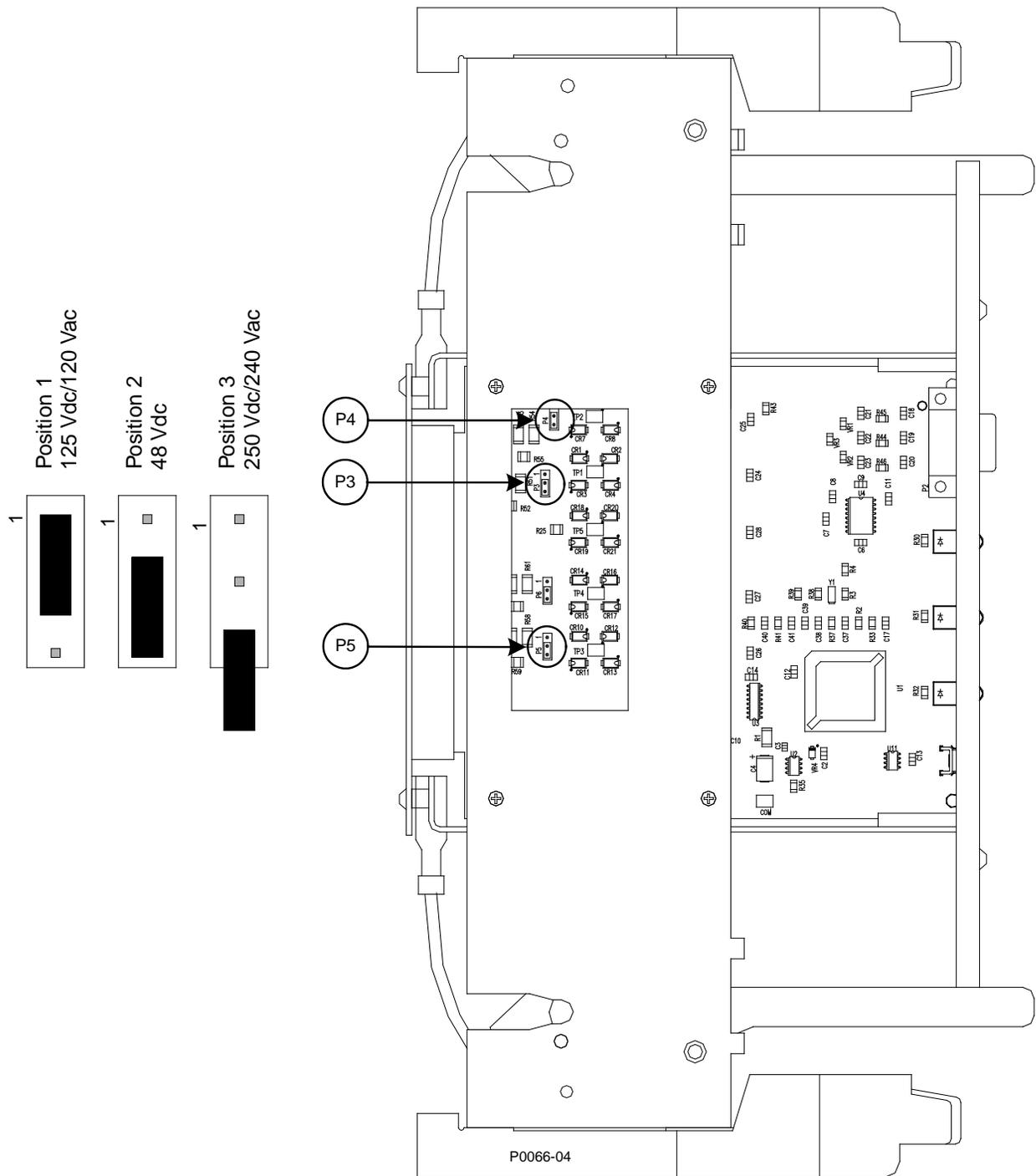
Figure 5-3. Contact Sensing Jumper Locations and Positions

Relay Installation

Perform the following procedure to install the BE1-79A relay.

1. Insert the BE1-79A relay and close the cradle latches to lock the relay into the case.

2. Enter the desired settings through the front serial communication port. Information about configuring HyperTerminal and Terminal for communication with the BE1-79A is provided in Appendix B, *Terminal Communication*. Refer to Section 4, *Communication Commands* for information about relay communication and ASCII commands.

3. Install the relay cover.

Communication Connections and Settings

The required connections and settings for BE1-79A communication are described in the following paragraphs.

Communication Connector

The BE1-79A uses a standard RS-232 (DB-9) female connector located on the front panel. Connector pin numbers, functions, names, and signal directions are listed in Table 5-1. Figure 5-4 provides a connection diagram for connecting the BE1-79A relay to a personal computer (PC).

Table 5-1. RS-232 Pin Functions

Pin	Function	Name	Direction
1	Shield	—	N/A
2	Transmit Data	TXD	From Relay
3	Receive Data	RXD	Into Relay
4	N/C	—	N/A
5	Signal Ground	GND	N/A
6	N/C	—	N/A
7	N/C	—	N/A
8	N/C	—	N/A
9	N/C	—	N/A

NOTE

The RS-232 communication ports are not equipped with request-to-send (RTS) and clear-to-send (CTS) control lines. This makes the BE1-79A incompatible with systems that require hardware handshaking or systems that use self-powered RS-232 to RS-485 converters connected to the RS-232 ports.
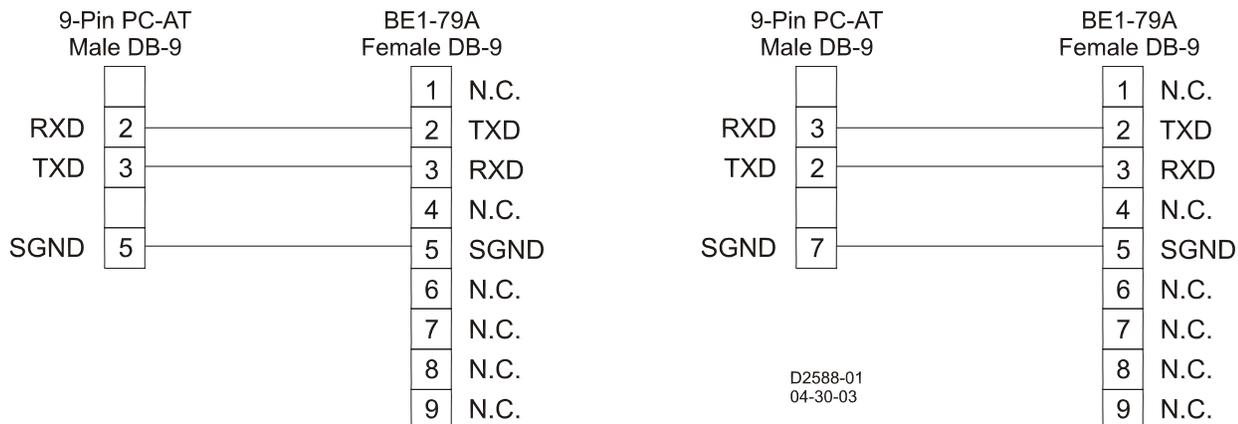
Figure 5-4. PC to BE1-79A Connections

Communication Settings

Communication settings are the formal set of conventions controlling the format and relative timing of message exchange between two communication terminals. The BE1-79A settings are fixed at 9600, 8N1, where 9600 is the baud rate, 8 is the number of data bits, N is the parity (none), and 1 indicates one stop bit. Since the communication settings of the relay are fixed, you must adjust your communication program settings to match the relay settings. Information about configuring Windows® HyperTerminal for communication with the BE1-79A is provided in Appendix B, *Terminal Communication*.

SECTION 6 • TESTING

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SECTION 6 • TESTING

Introduction

You may prefer to test your relay before installation. To test BE1-79A relay functionality, perform the procedures in the following paragraphs. Figure 6-1 illustrates the necessary connections.

> **NOTE**
>
> The following test procedures specify 120 Vac for relay power and the contact sensing inputs. Therefore, contact sensing jumpers P3, P4, and P5 must be set in position 1 or position 2. The contact sensing circuitry will not function with 120 Vac applied and the contact-sensing jumpers setting position 3.

Instantaneous Reclose Testing

1. Place Test switch S1 in the 52a position and apply 120 Vac to the relay and test circuit.
2. Connect a PC with a serial port and suitable communication software to the relay serial port. Transmit the settings of Table 6-1 to the relay.

Table 6-1. Instantaneous Reclose Testing Commands

Command	Time Between Recloses
ACCESS=<cr>	N/A
SP-79A1=0,5<cr>	0 – 0 = 0s
SP-79A2=10,15<cr>	10 – 0 = 10s
SP-79A3=20,25<cr>	20 – 10 = 10s
SP-79A4=30,35 <cr>	30 – 20 = 10s
SP-79ALO=40,45<cr>	40 – 30 = 10s
SP-79ARS=E,10,40<cr>	N/A
EXIT<cr>	N/A
Y<cr>	N/A

3. Place Test switch S1 in the 52b position and observe that the following sequence of events occur.
   a. Front panel Reset LED turns off
   b. Front panel In Sequence LED lights
   c. Reclose indicators L1, L2, and L3 will light immediately and remain lit for three seconds
   d. After 10 seconds, L1, L2, and L3 will light for three seconds and RS indicator L5 will light and remain lit
   e. After 20 seconds, L1, L2, and L3 will light for three seconds
   f. After 30 seconds, L1, L2, and L3 will light for three seconds
   g. After 40 seconds, the front panel Lockout led and Lockout indicator L4 will light, and RS indicator L5 will turn off
4. Place Test switch S1 in the 52a position and observe that after five seconds, the front panel Reset LED lights.
5. Place Test switch S1 in the 52b position. When Reclose indicators L1, L2, and L3 light, momentarily place Test switch S1 in the 52a position and verify that L1, L2, and L3 turn off.
6. Place Test switch S1 in the 52b position and verify that after 10 seconds, L1, L2, and L3 light for three seconds.
7. Place Test switch S1 in the 52a position and verify that after 15 seconds, the front panel Reset LED lights.

Delayed Reclose Testing

1. Place Test switch S1 in the 52a position and apply 120 Vac to the relay and test circuit.
2. Connect a PC with a serial port and suitable communication software to the relay serial port. Transmit the settings of Table 6-2 to the relay. (These settings correspond to the illustration of Figure 3-3.)

Table 6-2. Delayed Reclose Testing Commands

Command	Time Between Recloses
ACCESS=<cr>	N/A
SP-79A1=10,20<cr>	10 – 0 = 10 s
SP-79A2=30,40<cr>	30 – 10 = 20 s
SP-79A3=50,60<cr>	50 – 30 = 20 s
SP-79A4=70,80 <cr>	70 – 50 = 20 s
SP-79ALO=180,185<cr>	180 – 70 = 110 s
SP-79ARS=E,30,180<cr>	N/A
EXIT<cr>	N/A
Y<cr>	N/A

3. Place Test switch S1 in the 52b position and observe that the following sequence of events occur.
   a. Front panel Reset LED turns off
   b. Front panel In Sequence LED lights
   c. After 10 seconds, Reclose indicators L1, L2, and L3 will light for three seconds and RS indicator L5 will light and remain lit
   d. After 30 seconds, L1, L2, and L3 will light for three seconds
   e. After 50 seconds, L1, L2, and L3 will light for three seconds
   f. After 70 seconds, L1, L2, and L3 will light for three seconds
   g. After 180 seconds, the front panel Lockout led and Lockout indicator L4 will light and RS indicator L5 will turn off
4. Place Test switch S1 in the 52a position and observe that after five seconds, the front panel Reset LED lights.
5. Place Test switch S1 in the 52b position. When Reclose indicator L1, L2, and L3 light 10 seconds later, place S1 in the 52a position momentarily and verify that Reclose indicators L1, L2, and L3 turn off.
6. Place Test switch S1 in the 52b position before 20 seconds elapse and verify that after 30 seconds, Reclose indicators L1, L2, and L3 light for three seconds.
7. Place Test switch S1 in the 52a position and verify that after 40 seconds, the front panel Reset LED lights.
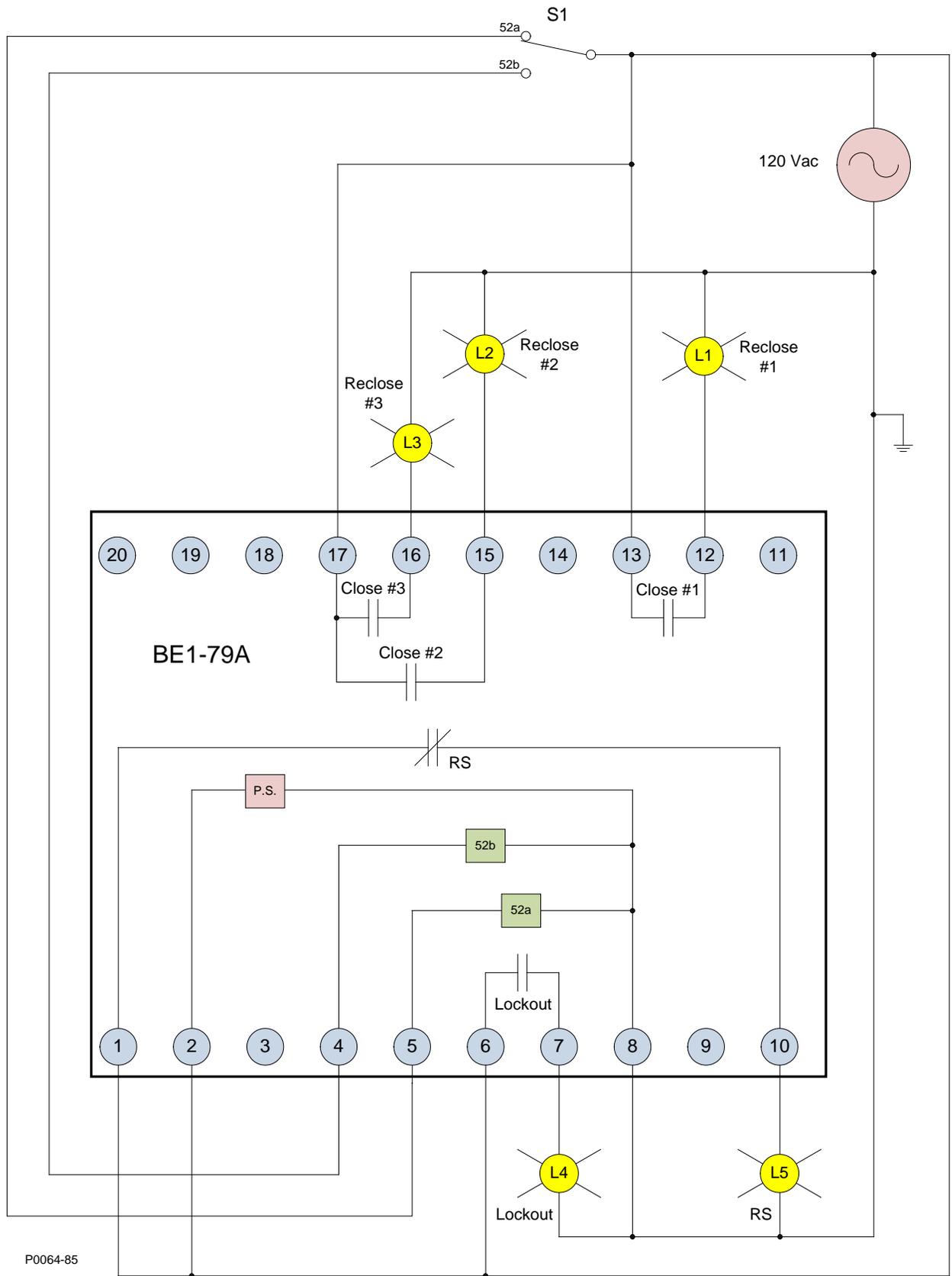
Figure 6-1. Test Connections

Troubleshooting Tips

The front panel LED indicators will annunciate certain conditions that will inhibit the BE1-79A relay from providing reclose protection.

Blinking LEDs

This annunciation indicates low or incorrect relay input voltage. Verify proper contact sensing jumper selection.

All LEDs On

This annunciation indicates an EEPROM error or recent cycling of relay operating power.

APPENDIX A • RS CONTACT APPLICATION

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APPENDIX A • RS CONTACT APPLICATION

Introduction

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. It can also be used to block transformer load tap changer (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

To illustrate RS contact operation, Table A-1 lists the possible setting combinations for SP-79ARS command mode (D or E). RS is a normally closed contact.

Table A-1. RS Contact Operation Table

SP-79ARS Command Parameters	RS Contact State When:			
	BE1-79A Power Off	BE1-79A Reset	Applied	Removed
D,0,145	Closed	Closed	Opens as soon as 52b makes	Closes at 145 s
D,2.5,145	Closed	Closed	Opens at 2.5 s	Closes at 145 s
E,0,145	Closed	Open	Closes as soon as 52b makes	Opens at 145 s
E,2.5,145	Closed	Open	Closes at 2.5 s	Opens at 145 s

Table A-1 Notes

SP-79ARS command syntax is SP-79ARS[=<mode>,<apply time>,<remove time>]. Mode D indicates that the RS element is de-energized or "dropped out" when power is applied to BE1-79A terminals 2 and 8. Mode E indicates that the RS element is energized or picked up when power is applied to BE1-79A terminals 5 and 6.

In Applied mode, the RS contact functions opposite of the way it does in Removed mode and BE1-79A Power Off mode.

When the ac or dc operating power applied to terminals 5 and 6 is interrupted during a reclose sequence, the RS contact returns to the close state.

The mode of the RS contact offers the ability to invert the relay logic. In D (de-energized) mode, the position of the RS contact will follow the classic definition of relay logic:

- If RS logic is 0, the RS relay coil is de-energized.
- If RS logic is 1, the RS relay coil is energized.

In E (energized) mode, the relay logic is inverted and the RS coil is normally energized and then de-energized when the RS logic goes to 1. The effect is:

- 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 E logic is selected and the relay RS logic is 0, the RS coil will be energized and holding the output contact against its internal spring. However, if the relay loses power at this point, the RS contact will change to the close state. Table A-1 is based on these explanations and will be referred to throughout the remainder of this appendix.

RS Contact Settings

The RS contact setting command, SP-79ARS, determines the mode, apply time, and remove time of the RS contact. SP-79ARS command syntax is SP-79ARS[=<mode>,<apply time>,<remove time>].

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

- The relay has operating power applied to terminals 5 and 6
- The BE1-79A relay is in Reset while 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 indicated above. An Apply time set at zero is applied as soon as the circuit breaker 52b contact makes. An Apply time set at a value other than zero begins its timing sequence as soon as the breaker opens on its first trip and the 52b contact makes. Remove time also begins when the 52b 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 BE1-79A returns to Reset.
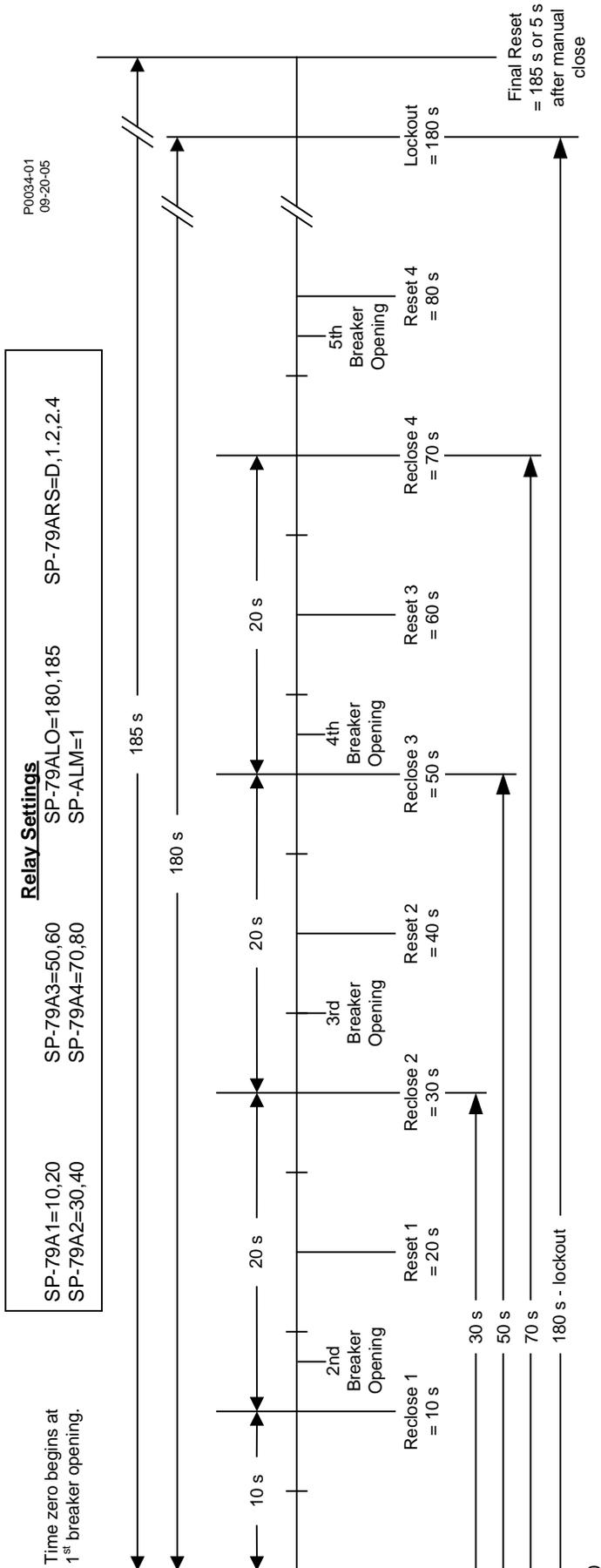
Figure A-1. RS Contact Setting Examples
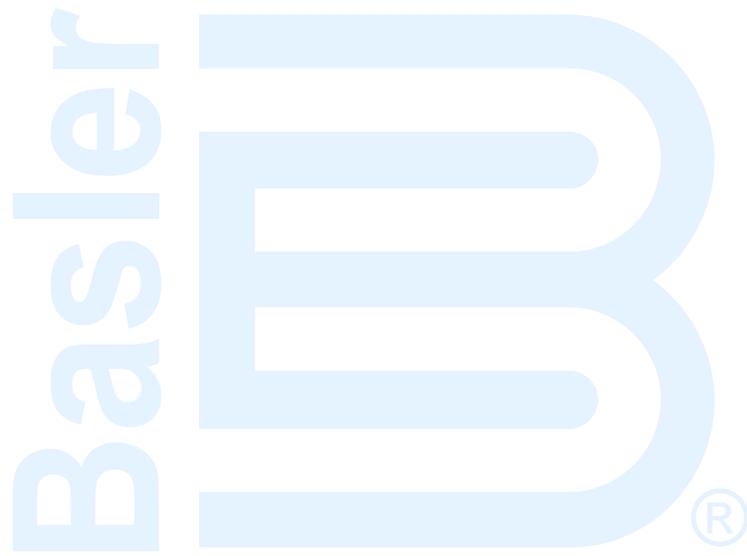
APPENDIX B • TERMINAL COMMUNICATION

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APPENDIX B • TERMINAL COMMUNICATION

Windows® 2000/XP

HyperTerminal (provided with Windows® 2000/XP) or other stand-alone software can be used to communicate with a BE1-79A relay. The following instructions are used for configuring HyperTerminal in Windows 2000/XP to communicate with your BE1-79A relay. The configuration of other stand-alone software is similar.

Step 1: Click Start: Highlight Programs, Accessories, Communication, HyperTerminal.

Step 2: Click HyperTerminal to open the folder.

Step 3: Select the file or icon labeled Hypertrm or Hypertrm.exe. Once the program has started, you will be presented with a series of dialog boxes.

Step 4: Dialog Box: Connection Description
   a. Type the desired file name, for example, BE1-79A. See Figure B-1.
   b. Click "OK".

Figure B-1. Connection Description Dialog Box

Step 5: Dialog Box: Connect To
   a. Click the Connect using: drop-down menu. See Figure B-3.

       Select Direct To COMx, where x is the port you are using on your computer.
   b. Click "OK".

Figure B-2. Connect To Dialog Box

Step 6: Dialog Box: COMx Properties

    a.   Make the following selections using Figure B-3 as a guide:

        Set the bits per second setting so that it matches the setting of the relay. The default baud rate of the relay is 9,600.

        Set the Data bits at 8.

        Set the Parity to None.

        Set the Stop bits at 1.

        Set Flow control to Xon/Xoff.

    b.   Click "OK". This creates an icon with the file name entered in Step 4 and places it in the HyperTerminal folder. Future communication sessions can then be started by clicking the appropriate icon.
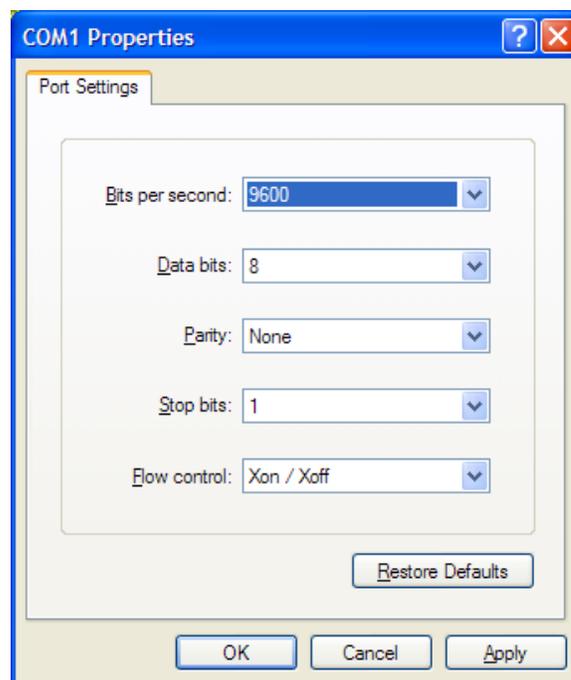
Figure B-3. COM Properties Dialog Box

Step 7: Click File/Properties on the menu bar. Click the Settings tab.

    a.   Make the following selections using Figure B-5 as a guide:

        Check the Terminal Keys radio button.

        Select VT-100 emulation.

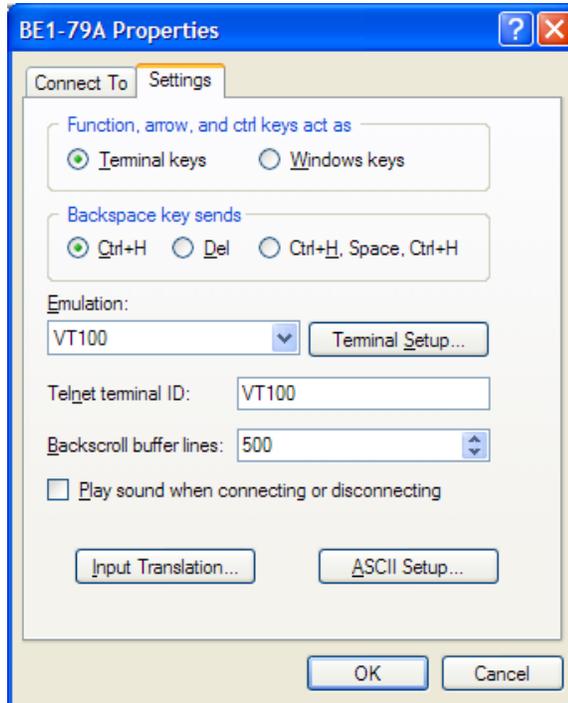   Set Backscroll buffer lines to the maximum setting of 500.

Figure B-4. Properties, Settings Tab

    b.   Click the ASCII Setup button. Make the following selections using Figure B-5 as a guide:

        <u>ASCII Sending</u>

        Place a check at <u>S</u>end line ends…

        Place a check at <u>E</u>cho typed characters…

        Set the <u>L</u>ine delay setting to 100 milliseconds.

        Set the <u>C</u>haracter delay setting to 0 milliseconds.

        <u>ASCII Receiving</u>

        Disable <u>A</u>ppend line feeds…by leaving the box unchecked.

        Disable <u>F</u>orce incoming… by leaving the box unchecked.

        Place a check at <u>W</u>rap lines…

    c.   Click "OK".

    d.   Click "OK".

Step 8: Click File and click Save.

NOTE

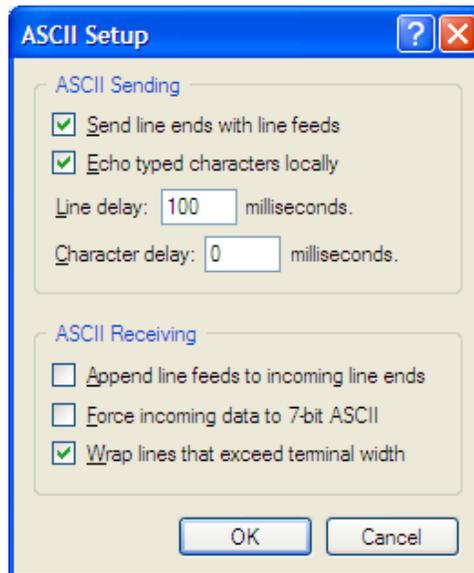Settings changes do not become active until the settings are saved.

Figure B-5. ASCII Setup Dialog Box

Step 9: HyperTerminal is now ready to communicate with the relay. Table B-1 describes the required connection for the RS-232 port.

Table B-1. RS-232 Communication Ports

Connection	Type
Front Port	9-pin female DCE
PC to Front RS-232 port cable	Straight

Windows® Vista and Windows® 7

HyperTerminal is not provided with Windows® Vista or Windows 7. Stand-alone software from other vendors can be used to communicate with a BE1-79A relay. The configuration of stand-alone software is similar to that of HyperTerminal.

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