

1.0 Introduction

Capacitor banks supply VARs to the system. Historically, some type of auxiliary parameter measuring controls (for example, time controls, voltage controls, current controls, or temperature controls) are used. When the required relationship is fixed and pre-definable, the controls operate satisfactorily. However, if the factors and relationships change with circuit loading, circuit changes or operating conditions, the controls will not operate effectively.

The Beckwith Electric M-2501A Autodaptive® Capacitor Control is a unique solution to pole-top capacitor bank control requirements. Requiring only a voltage input, the control optimizes capacitor bank switching based, not only on measured voltage level, but also on past voltage profiles.

The control records information such as changes in voltage during a switch operation and also voltage fluctuations during a 24-hour period. The unit has customer settable voltage limits which maintain the operation of the device within a certain range of allowable voltages for operation, and an option to set the voltage level.

1.1 Principles of Operation

The Autodaptive Capacitor Control samples the local voltage at a rate of 240 samples per half-cycle.

Initialization

Initialization of the unit causes the following major actions to take place: a) opens the capacitor bank, b) sets the bandwidth to zero and c) sets the reference voltage to 120 V, d) sets the integrating timer, H', to 800, e) sets the mode to automatic, f) places the control in the 24-hour fast averaging mode, and g) closes the bank, establishing a bandwidth.

24-Hour Fast Averaging Mode

If the measured voltage is not exactly 120 V ac, the control begins to slowly move the average voltage toward the measured voltage. It moves faster during the first 24-hour period following initialization than during subsequent periods. This permits the unit to “settle in” more quickly. (Not active if voltage level is set.)

Voltage Averaging

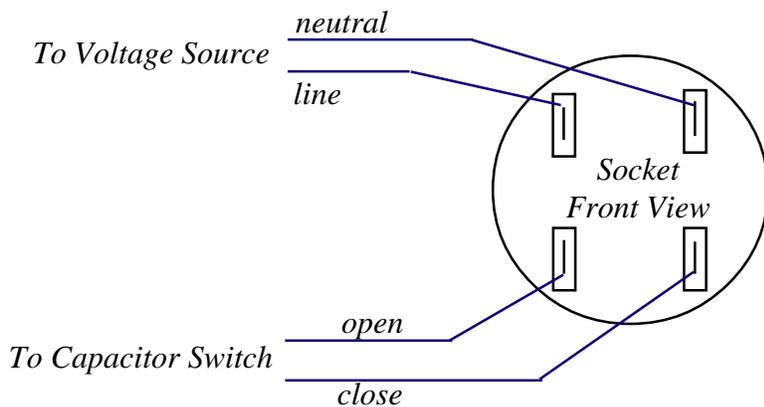
The M-2501A unit continually performs voltage averaging. Under normal operation, the time constraints develop a long-term average (approximately 7 days). After power down or initialization, the time constraints allows for a faster (24 hour) startup averaging period. (Not active if voltage level is set.)

Sensitivity Adjustment

If the control operates less or more frequently than its norm for an extended time, it will adjust its sensitivity (e.g., it adapts). If necessary, it will return to its 24-hour fast averaging mode and to its initial timer sensitivity value (adapting its sensitivity).

Communication Validation

Blink means the exchange of data between the host computer for the M-2801 BlincIR® program and the M-2501A control. Blinking is accomplished by aligning the infrared port of the palmtop, laptop or BecoEye® to the infrared port of the M-2501A, located at the bottom front of the control. If the exchange of data is successful, the host computer will respond with a one-second continuous tone (beep). If the transmission is unsuccessful, the host computer will issue two very short, falling pitch tones.



Note: ACC to be plugged into socket as illustrated.



If desired: Install band to seal unit and install meter seal.

Figure 1 Meter Socket Wiring Diagram

Voltage Regulation Quality Factor (VRQF)

This is the square root of a running recursive average of the sum of the square of the deviation of the fundamental component of controlled voltage from a desired voltage using a recursion time of 6 hours. More simply stated, it is an RMS calculation of voltage regulation error. Reduction of this VRQF value is indicative of more stable distribution circuit voltage control.

2.0 Installation of the Unit

The M-2501A is housed in a cylindrical Lexan™ meter case 6-3/4 inches in diameter by 5 inches deep. The device weighs approximately 2.5 lbs. The control takes a standard four-blade meter socket.

The connections are described below. The four contacts used in the meter socket are: (as noted clockwise from upper left when facing socket).

Line voltage – 120V ac from the Capacitor Bank VT for powering the control.

Neutral – common return for the line input voltage and the switched outputs.

Close – switches 120 V ac to the “close” terminal of a motor or solenoid driven capacitor switch.

Open – switches 120 V ac to the “open” terminal of a motor or solenoid driven capacitor switch.

The OPEN and CLOSE outputs use single pole relay contacts that make and carry up to 10 amperes total for a 15 second duration and 45 amperes total for a 0.1 second duration. (Contacts closed for 15 seconds.)

3.0 Installation of M-2801 BlinClR® Communication and Analysis Software

PC Installation

DOS Mode

1. Insert BlinClR program's 3-1/2 inch disk into A: drive.
2. At **C** prompt, type A:/Install and press Return. This will create a directory named **C:/Becoware/blincir**.
3. Type C:/Becoware/blincir/blincir.exe and press Return.

Windows 3.1 Mode

1. Insert BlinClR program's 3-1/2 inch disk into A drive.
2. From the Program Manager, select **File**, select **Run** and type A:/Install and press

Return. This will create a directory named **C:/Becoware/blincir**.

3. Go to the File Manager. Select C:/Becoware/blincir/blincir.exe to execute the program.

Windows '95 Mode

1. Insert BlinClR program's 3-1/2 inch disk into A drive.
2. Select **Start**, select **Run** and type A:/Install and press Return. This will create a directory named **C:/Becoware/blincir**.
3. Go to the Explorer. Select C:/Becoware/blincir/blincir.exe to execute the program.

Palmtop Installation:

NOTE: If the M-2906 Hewlett-Packard 200LX Palmtop PC is purchased through Beckwith Electric, it comes preloaded with the BlinClR software and it is not necessary to follow this installation procedure.

CAUTION: M-2801 BlinClR software will not run under WindowsCE Palmtop.

DOS Mode

Installation of BlinClR to the Palmtop requires HP Connectivity Pack.

1. Install LapLink software according to Hewlett Packard instructions.
2. Connect the Palmtop to the PC using the serial cable and instructions provided in the HP Connectivity Pack.
3. Start the Palmtop's built-in LapLink software by typing C:\LLRA. This will allow the PC to view the Palmtop as drive E:.
4. Wait for a 4 tone sound (handshake signal) which indicates a communication link between Palmtop and PC.
5. Install the Beckwith Electric 3.5" floppy disk into A: drive.
6. From the PC issue the command COPY A:.*E:. This will copy all the Beckwith Electric files over to the HP Palmtop.

Windows™ Mode:

1. Install LapLink software according to Hewlett Packard instructions.
2. Connect the Palmtop to the PC using the serial cable provided, according to instructions provided in the HP Connectivity Pack.

3. Start the Palmtop's built-in LapLink software from the Program Manager. This will allow the PC to see the Palmtop as drive E:
4. Wait for the 4 tone sound (handshake signal) which indicates a communication link between the Palmtop and PC.
5. Insert Beckwith Electric 3.5" floppy disk into drive A:
6. Use the File Manager to copy files from A: to E:

Flash Memory Card

1. Insert flash card into HP Palmtop and press (Filer) key.
2. Select A: drive and highlight **install.exe**, then press enter key.
3. When screen asks you to reboot, press yes. Wait for title screen.
4. Press the (Filer) key and then select A: drive; select directory A:\BLINCIR.
5. Highlight install.bat and press enter key. Follow prompt and press any key.
7. Hold down Alt-Ctrl-Del.
8. The BlincIR[®] program should now show.

Note: If you do not have access to a PC, a flash memory card with BlincIR pre-installed may be purchased from Beckwith Electric.

3.1 Checkout

NOTE: The ACC is preprogrammed for operation; it is not necessary to perform the checkout procedure before installation.

Necessary Equipment:

- ACC Autodaptive[®] Capacitor Control;
- M-2906 Hewlett-Packard 200LX Palmtop PC with M-2801 BlincIR Communication and Analysis Software installed
OR
- M-2920A BecoEye[®] Infrared Communications Adapter with a laptop PC and the M-2801 BlincIR Communication and Analysis Software installed;

Optional Equipment:

- optional sealing band;
- optional meter seal;
- optional M-2909 PCMCIA Card which includes the BlincIR Communication and Analysis Software.

- Optional M-2921 BecoEye Extension Cord.
- Optional M-2922 BecoEye "Y" adapter cord.

Required Information:

- location description for inputting identification;
- desired customer limit settings;
- instructions if resettable counter to be reset.

3.2 Using Hewlett-Packard 200LX Palmtop and M-2801 BlincIR Communication and Analysis Software

NOTE: The BlincIR program should already be installed on the HP 200LX palmtop if the palmtop was purchased through Beckwith Electric.

1. Install the ACC into the meter socket. See Figure 1 (page 1), Meter Socket Wiring Diagram.
2. Run the BlincIR program on the palmtop.
3. Blinc the ACC by aligning the palmtop's infrared port to the ACC's infrared port at a distance of up to 1.5 feet. The IR port is located on the bottom front of the control. Press F10 on the palmtop for the Blinc. The palmtop sounds a "beep" to verify the Blinc.
4. If this is the first Blinc for this ACC, input the location description in the Location field of the List Screen as prompted.
5. Verify that the Serial # and Location fields of the List Screen are accurate.
6. Press F9 for the Data Screen and check the Present Voltage and Count of Operations.
7. Initialize the ACC for this location as follows:
 - Press F3 for the Operation Screen
 - Use the arrow keys to select Initialize.
 - Press "*".
 - Align the infrared ports of the palmtop and the ACC.
 - Press F10.
 - The ACC will initiate an Open command in 30 seconds.
 - An automatic "Close" operation follows in five (5) minutes.

NOTE: Press Esc key to discontinue blinc.

8. To select the Manual mode of operation:
 - If the Operation Screen is not already displayed, press F3.
 - Use the arrow keys to select **Manual**.
 - Press “*”.
 - Align the infrared ports of the palmtop and the ACC.
 - Press F10.

9. To manually close a capacitor bank (the ACC must be in manual mode – see Step 8):
 - If the Operation Screen is not already displayed, press F3.
 - Use the arrow keys to select **Manual Close**.
 - Press “*”.
 - Align the infrared ports of the palmtop and the ACC.
 - Press F10.

The ACC will initiate a close command in 30 seconds (subject to a 5 minute delay from the last switch opening).

10. To check the ACC switch status and operating conditions:
 - Press F9 for the Data Screen.
 - Verify the following:
 - present voltage
 - operation count
 - bandwidth
 - switch position.

11. To obtain a graph of the switch operation:
 - Press F8 for the Graph Screen.
 - Verify an operating time and data points equal to the bandwidth for the close operation.

12. If the resettable counter should be reset:
 - Press F3 for the Operation Screen.
 - Use the arrow keys to select **Reset Counter**.
 - Press “*”.
 - Align the infrared ports of the palmtop and the ACC.

13. If the customer-desired upper and lower voltage levels are to be changed from the default values of 126 volts for the upper level and 114 volts for the lower level:
 - Press F10.
 - Press F6 for the Limits Screen.
 - Use the arrow keys to highlight the voltage level being changed.
 - Press Enter.
 - Input the new value.
 - Press Enter.
 - Repeat the last four steps for the other voltage level if a change is desired.
 - Use the arrow keys to highlight **WRITE**.
 - Align the infrared ports of the palmtop and the ACC.
 - Press F10.

14. To return the ACC to Automatic mode of operation:
 - Press F3 for the Operation Screen.
 - Use the arrow keys to select **Automatic**.
 - Press “*”.
 - Align the infrared ports of the palmtop and the ACC.
 - Press F10.

15. To confirm Automatic mode of operation:
 - Press F9.
 - Verify:
 - mode of operation as Automatic
 - other parameters as desired.

WARNING: A 30-second delay is built into the ACC between the time the unit is Blinded and switch is operated. This is to allow personnel sufficient time to vacate the immediate area as a safety precaution against switch or capacitor bank malfunction.

Function Keys

The function keys, F1 through F10, on the palmtop or laptop are used to display specific information.

- F1 - Help
- F2 - List
- F3 - Operate
- F4 - VRQF
- F5 - Print
- F6 - Limit
- F7 - Exit
- F8 - Graph
- F9 - Data
- F10 - Blinc

Following is a description for each function key used in the M-2801 BlincIR® Communication and Analysis Program.

F1: Help

A help screen is provided for the following screens:

- a. F2 (List)
- b. F3 (Operate)
- c. F4 (VRQF)
- d. F6 (Limit)
- e. F8 (Graph)
- f. F9 (Data)

F5 (Print), F7 (Exit) and F10 (Blink) are action keys, therefore there are no help screens available.

Press F1 to get help on the screens: F2, F3, F4, F6, F8 and F9. You have to be in these screens to get help on those specific screens.

F2: List

This screen lists individual M-2501A units by serial numbers, giving mode of operations and installed locations. The serial number is assigned at the factory. The location is entered by the customer when the M-2501A is Blinc'd by pressing F10 for the first time, thereby saving the location information with the serial number. When the unit is Blinc'd (see F10 description) again, the new data replaces the previous data at that serial number. When the unit is relocated, it is necessary to delete the "old" location by pressing the "del" key on the highlighted location, and reentering the new location before Blinc'ing the unit.

See Figure 2 (page 12) for an example of "List" display. Once a file is chosen, press Enter to load data. The "m" and "a" under "mode" column means the M-2501A is in "manual" or "automatic" mode respec-

tively. See "operate" mode (F3) manual/automatic mode transfer.

To add a new unit to the list, Blinc the unit. (Point the palmtop's infrared port to the infrared port of the M-2501A and press F10.) The screen will prompt you to enter the location. The number of characters is limited to 18. If you try to enter more than 18 characters, you will hear a short "beep."

The list contains 16 units on each page. If you have more than one page (screens) for the list, you can view the next screen by pressing the forward arrow key. You can see the previous page, (assuming you are not on page 1) by pressing the backward arrow key.

NOTE: The list is limited to 256 units, i.e. 16 pages total.

F3: Operate

This screen is used to select modes of operation for the M-2501A. The M-2501A can be toggled between manual and automatic operation. When in manual mode, a manual close or open can be performed. Also, the resettable counter can be reset to zero, and the M-2501A can be initialized. Use the up and down arrow keys to select the desired function.

Automatic – sets the M-2501A in automatic mode. The M-2501A adapts to the line conditions and switches the capacitor bank as needed without any operator intervention.

Manual – sets the M-2501A in manual mode. In this mode, the operator switches the capacitor banks on or off.

Manual Close – Prior to selecting this mode, the "manual" selection must be made. If it is not in "manual," "control is in automatic" will appear on the screen. To close the bank, select "manual close," press the asterisk key, then the F10 key. A built-in 30-second delay will be in effect before the capacitor closes. There may also be a 5-minute delay due to a previous "open" operation of the capacitor bank. When the countdown starts on the screen, it is recommended that the operator step back or leave the area for safety reasons while the capacitor bank closes.

Manual Open – Prior to selecting this mode, the "manual" selection must be made. If it is not in "manual," "control is in automatic" will appear on the screen. To open the bank, select "manual open," press the asterisk key, then the F10 key. A built-in 30-second delay will be in effect before the capacitor opens. When the countdown starts on the screen, it is recommended that the operator step back or leave the area for safety reasons while the capacitor bank opens.

Reset Counter – resets the counter to 0. See data screen (F9) for details.

Initialize – Unit may be initialized to permit quicker adjustment to the location parameters. Initialization a) opens the capacitor bank, b) sets the bandwidth to zero and c) sets the reference voltage to 120 V, d) sets the integrating timer, H', to 800, e) sets the mode to automatic, f) places the control in the 24-hour fast averaging mode, and g) closes the control. These values can be viewed on the data screen by pressing F9.

F4: VRQF

This screen displays the VRQF (Voltage Regulation Quality Factor) and the voltage for the last 24 hours (see Figure 4).

F5: Print

This screen is used with an HP 200LX Palmtop PC connected to a printer by a Beckwith Electric M-2905 printer cable. Follow the setup instructions for the printer that were provided with the palmtop.

F6: Limits and Fixed Voltage Setpoint

This screen allows the user to perform two separate functions.

The first function permits the customer to set upper and lower voltage levels. If switching of the bank would cause the location voltage to violate these customer-desired limits, the control will refrain from operation. If the location voltage drifts outside these settings, the M-2501A will act through the non-linear timers to switch the bank as necessary. These limits are factory set at 126V for the upper level and 114V for the lower level.

The second function allows the user to set the control to function around a fixed voltage setpoint (from 98.0 to 132.0). Setting this parameter to 0.0V disables the fixed voltage setpoint operation. When enabled, the control will not adapt to a changing voltage profile, but will switch around the fixed voltage setpoint, using an adaptive timer.

On this screen the “write” button must be activated after any voltage value is entered (Figure 5, page 14).

F7: Exit

This screen exits the BlincIR® program.

F8: Graph

This screen is only active after a location has been chosen in the list of data (Function F2). See Figure 6 for an example of a historical display for the chosen location.

F9: Data

This screen is only active after a location has been chosen in the list of data (Function F2). See Figure 7.

F10: Blinc

This key Blincs the M-2501A. This Blinc transmits all data to the palmtop from the M-2501A and transmits any new setpoints or operation commands to the M-2501A. (The palmtop emits an audible “beep” to verify that communication was completed.) Remember that under outdoor, sunny conditions, the 10' blinc range is only valid if the BecoEye® can be shaded from sunlight without interrupting the communication path.

3.3 Troubleshooting: Palmtop

1. Observe the F8 screen. If the reference voltage line (the thick square wave) does not vary, the capacitor bank is not switching properly. Possible problems are:
 - a. A blown fuse in the M-2501A unit. The ACC uses an MDA 10 Amp fastblow ceramic case fuse.
 - b. A capacitor bank problem.
 - c. An M-2501A failure.
2. If the F8 screen on the palmtop does not display a graph, the unit either re-initialized or had a loss of power. This is not a problem as the unit's operation will not be affected.
3. If H' on the F9 screen is consistently 4000, the bank is cycling frequently. The switch should be monitored frequently for wear or failure due to the high number of switching operations.
4. If the unit will not Blinc:
 - a. Shade the infrared port on the M-2920A BecoEye IR adapter unit from direct sunlight while Blincing.
 - b. Place the palmtop against the M-2501A infrared port and slowly draw it away from the unit while Blincing.
 - c. If batteries are low (one line on the F2 screen for battery level), replace batteries and try again.
 - d. If unit still won't Blinc, contact Beckwith Electric.

Note: If batteries are allowed to run down, BlincIR will be lost from memory, unless the optional flash memory card is installed.

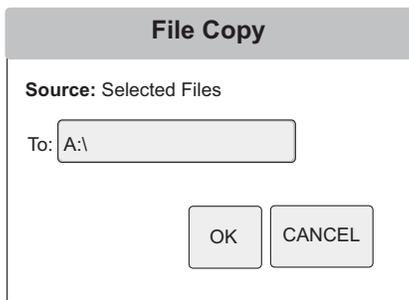
3.4 File Back Up to a Flash Memory Card (Palmtop)

Note: If “Filer” is running, perform the following steps:

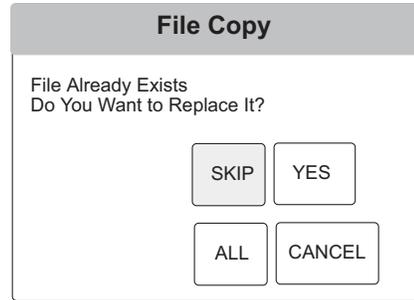
1. Press  to highlight “file” pull-down menu.
2. Press  to reach “Exit” at bottom of menu.
3. Press  Filer is now closed.

Proceed with backup. **Note:** If not already in place, insert the Flash card at this time.

1. Press  “filer” icon button.
2. Highlight bar will be on “..” (parent directory return).
3. Highlight all files and folders on Drive C: (left side of screen) by using appropriate arrow key, and press space bar to select. Selected files will show a diamond shape at the left of the file name.
4. Press  (copy). Screen will display:



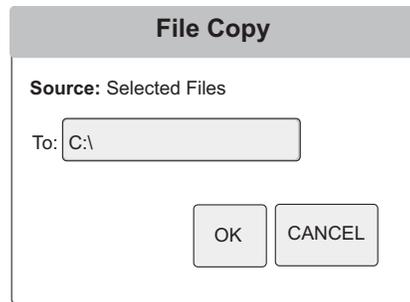
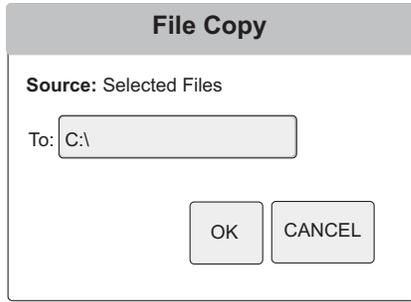
5. If A:\ is not highlighted after TO:, type “A:\”, and press Enter to complete file transfers from Drive C: to Drive A:.
6. If files already exist on Drive A:, the following will be displayed:



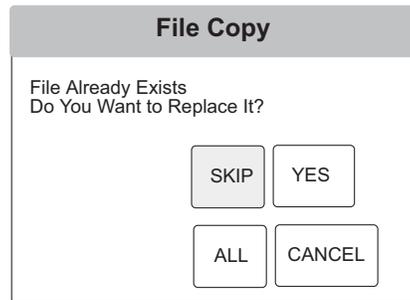
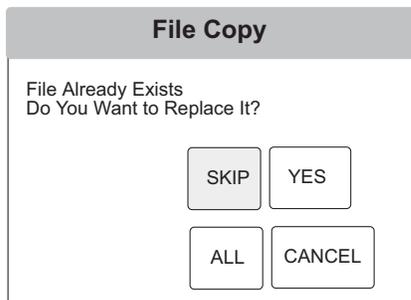
7. Using Tab key, highlight ALL. Press  to complete file transfer from Drive C to Drive A. Transfer is complete.

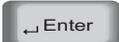
3.5 File Restore After Battery Failure (Palmtop)

1. Install fresh batteries. Computer should turn on automatically. If not, press ON.
2. If not already in place, insert Flash card.
3. Press  “filer” icon button.
4. Use arrow keys to move highlight bar to right side of screen (drive A:). Highlight bar will be on “..” (parent directory return).
5. Highlight all files and folders which were backed up from drive C: (see section 3.10), except “_dat” directory on Drive A: by using the appropriate arrow key, and press the space bar to select. Selected files are indicated by a diamond symbol to the left of the file name.
6. Press  (copy). Screen will display:



7. If C:\ is not highlighted after TO:, type "C:\".
8. Press . Screen will display:



11. Select All files with tab key .
12. Press .
13. You will still need to restore the "_dat" directory from Drive A: to C:. Move the highlight bar to "_dat" ;by using the appropriate arrow key.
14. Press .
15. Select all files by pressing  and the space bar. Selected files are indicated by a diamond symbol to the left of the file name. Note: Do not select the file "setup.env". If selected, press the space bar a second time over the highlighted file to deselect (diamond symbol should disappear). The HP 200LX will beep after the last file has been reached.
16. Press  (copy). Screen will display:
17. Make sure that "TO: C:_dat" is highlighted. If it does not appear, type "C:_dat" in the space following "TO:". ("_" may be typed by pressing Shift key and the - key (to the right of numeral 3)).
18. Press .
19. Using TAB key, highlight ALL.
20. Press .

Transfer is complete.

3.6 Accessories, M-2801 BlincIR[®] Communication and Analysis Software: Palmtop

Supplied on 3-1/2 inch disk for installing directly to the HP 200LX Palmtop PC through an IBM-compatible PC. (The M-2907 HP Connectivity Pack is also required for the palmtop installation.)

M-2906 Hewlett-Packard 200LX Palmtop PC

Includes the preloaded M-2801 BlincIR Communication and Analysis Software. One palmtop PC is capable of maintaining up to 256 records of individual M-2501A Autodaptive[®] Capacitor Controls, if the optional flash memory card is installed.

M-2907 Hewlett-Packard Connectivity Pack

Required for communication between an HP 200LX Palmtop PC and an IBM-compatible PC.

M-2908 Hewlett-Packard AC/DC Adapter

For use with the M-2906 HP 200LX Palmtop PC.

M-2909 Flash Memory (PCMCIA format) Card

Includes preloaded M-2801 BlinclR Communication and Analysis Software. May be purchased separately.

- a. Fits into PCMCIA type 2 slot on the HP 200LX Palmtop PC.
- b. Provides the BlinclR software to a HP 200LX Palmtop PC.
- c. Provides additional capacity for maintaining individual M-2501A Autodaptive Capacitor Controls.

3.7 Using Laptop with a Compatible Infrared Port and M-2801 BlinclR Communication and Analysis Software

NOTE: The BlinclR program should already be installed on the laptop. If not, see the installation instructions in Section 3.0.

- 1. Install the ACC into the meter socket. See Figure 1, Meter Socket Wiring Diagram (page 1).
- 2. Determine which communication port is being used by the laptop's infrared port. (This communication port number is designated as "n" in the following typing string.) Run the BlinclR program by typing blincir.exe/b/Cn. Press **ENTER**.
- 3. Blinc the ACC by aligning the laptop's infrared port to the ACC's infrared port at a distance of up to 2 feet. The IR port is located on the bottom front of the control. Press F10 on the laptop for the Blinc. The laptop sounds a "beep" to verify the Blinc.
- 4. If this is the first Blinc for this ACC, input the location description in the Location field of the List Screen as prompted.
- 5. Verify that the Serial # and Location fields of the List Screen are accurate.
- 6. Press F9 for the Data Screen and check the Present Voltage and Count of Operations.
- 7. Initialize the ACC for this location as follows:
 - Press F3 for the Operation Screen

- Use the arrow keys to select Initialize.
- Press ******.
- Align the infrared ports of the laptop and the ACC.
- Press F10.
The ACC will initiate an Open command in 30 seconds.
- An automatic "Close" operation follows in five (5) minutes.

- 8. To select the Manual mode of operation:
 - If the Operation Screen is not already displayed, press F3.
 - Use the arrow keys to select **Manual**.
 - Press ******.
 - Align the infrared ports of the laptop and the ACC.
 - Press F10.
- 9. To manually close a capacitor bank the ACC must be in Manual mode (see Step 8, above):
 - If the Operation Screen is not already displayed, press F3.
 - Use the arrow keys to select **Manual Close**.
 - Press ******.
 - Align the infrared ports of the laptop and the ACC.
 - Press F10.
 - The ACC will initiate a Close command in 30 seconds (subject to a 5 minute delay from the last switch opening).
- 10. To check the ACC switch status and operating conditions:
 - Press F9 for the Data Screen.
 - Verify the following:
 - present voltage
 - operation count
 - bandwidth
 - switch position.
- 11. To obtain a graph of the switch operation:

- Press F8 for the Graph Screen.
 - Verify an operating time and data points equal to the bandwidth for the close operation.
12. If the resettable counter should be reset:
- Press F3 for the Operation Screen.
 - Use the arrow keys to select **Reset Counter**.
 - Press “*”.
 - Align the infrared ports of the laptop and the ACC.
 - Press F10.
13. If the customer-desired upper and lower voltage levels are to be changed from the default values of 126 volts for the upper level and 114 volts for the lower level:
- Press F6 for the Limits Screen.
 - Use the arrow keys to highlight the voltage level being changed.
 - Press Enter.
 - Input the new value.
 - Press Enter.
 - Repeat the last four steps for the other voltage level if a change is desired.
 - Use the arrow keys to highlight **WRITE**.
 - Align the infrared ports of the laptop and the ACC.
 - Press F10.
14. To return the ACC to Automatic mode of operation:
- Press F3 for the Operation Screen.
 - Use the arrow keys to select **Automatic**.
 - Press “*”.
 - Align the infrared ports of the laptop and the ACC.
 - Press F10.

15. To confirm Automatic mode of operation:
- Press F9.
 - Verify:
 - mode of operation as Automatic
 - other parameters as desired.

WARNING: A thirty-second delay is built into the ACC between the time the unit is Blinded and the switch is operated. This is to allow personnel sufficient time to vacate the immediate area as a safety precaution against switch or capacitor bank malfunction.

3.8 Using Laptop without an Infrared Port (or with an incompatible Infrared Port) and using an M-2920A BecoEye[®] Infrared Communications Adapter and M-2801 BlinclR[®] Communication and Analysis Software

NOTE: The BlinclR program should already be installed on the laptop. If not, see the installation instructions in Section 3.0.

1. Install the ACC into the meter socket. See Figure 1, Meter Socket Wiring Diagram.
2. Connect the BecoEye to the laptop as follows: place the PS-2 and RS-232 connectors from the BecoEye cable into the keyboard port and the RS-232 port, respectively, on the rear of the IBM-compatible laptop computer.
3. Run the BlinclR program on the laptop by typing blincir.exe. Press Enter.
4. Blinc the ACC by aligning the BecoEye’s infrared adapter to the ACC’s infrared port at a distance of up to 10 feet. The IR port is located on the bottom front of the control. Press F10 on the laptop for the Blinc. The laptop sounds a “beep” to verify the Blinc.
5. If this is the first Blinc for this ACC, input the location description in the Location field of the List Screen as prompted.
6. Verify that the Serial # and Location fields of the List Screen are accurate.

7. Press F9 for the Data Screen and check the Present Voltage and Count of Operations.
8. Initialize the ACC for this location as follows:
 - Press F3 for the Operation Screen
 - Use the arrow keys to select Initialize.
 - Press “*”.
 - Align the infrared ports of the BecoEye[®] and the ACC.
 - Press F10.
 - The ACC will initiate an Open command in 30 seconds (see *Undefeatable Time Delays*, pg 6).
 - An automatic “Close” operation follows in five (5) minutes.
9. To select the Manual mode of operation:
 - If the Operation Screen is not already displayed, press F3.
 - Use the arrow keys to select **Manual**.
 - Press “*”.
 - Align the infrared ports of the BecoEye and the ACC.
 - Press F10.
10. To manually close a capacitor bank (the ACC must be in manual mode—see Step 8):
 - If the Operation Screen is not already displayed, press F3.
 - Use the arrow keys to select **Manual Close**.
 - Press “*”.
 - Align the infrared ports of the BecoEye and the ACC.
 - Press F10.
 - The ACC will initiate a Close command in 30 seconds. (see *Undefeatable Time Delays*, this page)
11. To check the ACC switch status and operating conditions:
 - Press F9 for the Data Screen.
 - Verify the following:
 - present voltage
 - operation count
 - bandwidth
 - switch position.
12. To obtain a graph of the switch operation:
 - Press F8 for the Graph Screen.
 - Verify an operating time and data points equal to the bandwidth for the close operation.
13. If the resettable counter should be reset:
 - Press F3 for the Operation Screen.
 - Use the arrow keys to select **Reset Counter**.
 - Press “*”.
 - Align the infrared ports of the BecoEye and the ACC.
 - Press F10.
14. If the customer-desired upper and lower voltage levels are to be changed from the default values of 126 volts for the upper level and 114 volts for the lower level:
 - Press F6 for the Limits Screen.
 - Use the arrow keys to highlight the voltage level being changed.
 - Press Enter.
 - Input the new value.
 - Press Enter.
 - Repeat the last four steps for the other voltage level if a change is desired.
 - Use the arrow keys to highlight **WRITE**.
 - Align the infrared ports of the BecoEye and the ACC.
 - Press F10.

15. To return the ACC to Automatic mode of operation:
 - Press F3 for the Operation Screen.
 - Use the arrow keys to select **Automatic**.
 - Press “*”.
 - Align the infrared ports of the BecoEye and the ACC.
 - Press F10.
16. To confirm Automatic mode of operation:
 - Press F9.
 - Verify:
 - mode of operation as Automatic
 - other parameters as desired.

WARNING: A thirty-second delay is built into the ACC between the time the unit is Blinced and the switch is operated. This is to allow personnel sufficient time to vacate the immediate area as a safety precaution against switch or capacitor bank malfunction.

Undefeatable Time Delays:

An **OPEN** or **CLOSE** command initiates a 30 second delay before operating the bank. After opening the bank, a five minute timer prevents the control from closing until the time has expired. During these five minutes, a decrementing timer is displayed in the upper right-hand corner of the F9 screen. The five minute timer must expire before a **CLOSE** command can be entered.

Function Keys

The function keys, F1 through F10, on the laptop are used to display specific information.

- F1 - Help
- F2 - List
- F3 - Operate
- F4 - VRQF
- F5 - Print
- F6 - Limit
- F7 - Exit
- F8 - Graph
- F9 - Data
- F10 - Blinc

Following is a description for each function key used in the M-2801 BlinclR® Communication and Analysis Program.

F1:Help

A help screen is provided for the following screens:

- a. F2 (List)
- b. F3 (Operate)
- c. F4 (VRQF)
- d. F6 (Limit)
- e. F8 (Graph)
- f. F9 (Data)

F5 (Print), F7 (Exit) and F10 (Blink) are action keys, therefore there are no help screens available.

Press F1 to get help on the screens: F2, F3, F4, F6, F8 and F9. You have to be in these screens to get help on those specific screens.

F2: List

This screen lists individual M-2501A units by serial numbers, giving mode of operations and installed locations. The serial number is assigned at the factory. The location is entered by the customer when the M-2501A is Blinced by pressing F10 for the first time, thereby saving the location information with the serial number. When the unit is Blinced (see F10 description) again, the new data replaces the previous data at that serial number. When the unit is relocated, it is necessary to delete the “old” location by pressing the “del” key on the highlighted location, and reentering the new location before Blinching the unit.

See Figure 2 for an example of “List” display. Once a file is chosen, press Enter to load data. The “m” and “a” under “mode” column means the M-2501A is in “Manual” or “Automatic” mode respectively. See “operate” mode (F3) manual/automatic mode transfer.

To add a new unit to the list, Blinc the unit. (Point the BecoEye® or the laptop’s infrared port to the infrared port of the M-2501A and press F10.) The screen will prompt you to enter the location. The number of characters is limited to 18. If you try to enter more than 18 characters, you will hear a short “beep.”

The list contains 16 units on each page. If you have more than one page (screens) for the list, you can view the next screen by pressing the forward arrow key. You can see the previous page, (assuming you are not on page 1) by pressing the backward arrow key.

F3: Operate

This screen is used to select modes of operation for the M-2501A. The M-2501A can be toggled between manual and automatic operation. When in manual mode, a manual close or open can be performed. Also, the resettable counter can be reset to zero, and the M-2501A can be initialized. Use the up and down arrow keys to select the desired function.

Automatic – sets the M-2501A in automatic mode. The M-2501A adapts to the line conditions and switches the capacitor bank as needed without any operator intervention.

Manual – sets the M-2501A in manual mode. In this mode, the operator switches the capacitor banks on or off.

Manual Close – Prior to selecting this mode, the “manual” selection must be made. If it is not in “manual,” “control is in automatic” will appear on the screen. To close the bank, select “manual close,” press the asterisk key, then the F10 key. A built-in 30-second delay will be in effect before the capacitor closes. There may also be a 5-minute delay due to a previous “open” operation of the capacitor bank. When the countdown starts on the screen, it is recommended that the operator step back or leave the area for safety reasons while the capacitor bank closes.

Manual Open – Prior to selecting this mode, the “manual” selection must be made. If it is not in “manual,” “control is in automatic” will appear on the screen. To open the bank, select “manual open,” press the asterisk key, then the F10 key. A built-in 30-second delay will be in effect before the capacitor opens. When the countdown starts on the screen, it is recommended that the operator step back or leave the area for safety reasons while the capacitor bank opens.

Reset Counter – resets the counter to 0. See data screen (F9) for details.

Initialize – Unit may be initialized to permit quicker adjustment to the location parameters. Initialization a) opens the capacitor bank, b) sets the bandwidth to zero and c) sets the reference voltage to 120 V, d) sets the integrating timer, H', to 800, e) sets the mode to automatic, f) places the control in the 24-hour fast averaging mode, and g) closes the control. These values can be viewed on the data screen by pressing F9.

F4: VRQF

This screen displays the VRQF (Voltage Regulation Quality Factor) and the voltage for the last 24 hours. See Figure 4 (page 14).

F5: Print

If a laptop is being used, F5 will not act as a print command. Instead, it functions as a transceiver optimizer; a toggle between the M-2501 and the M-2501A effective communication settings.

NOTE: To print from a laptop while running Windows: With the desired screen in view, press the “Print Screen” key, execute the Windows Paint program, and select Paste.

F6: Limits and Fixed Voltage Setpoint

This screen allows the user to perform two separate functions.

The first function permits the customer to set upper and lower voltage levels. If switching of the bank would cause the location voltage to violate these customer-desired limits, the control will refrain from operation. If the location voltage drifts outside these settings, the M-2501A will act through the non-linear timers to switch the bank as necessary. These limits are factory set at 126V for the upper level and 114V for the lower level.

The second function allows the user to set the control to function around a fixed voltage setpoint (from 98.0 to 132.0). Setting this parameter to 0.0V disables the fixed voltage setpoint operation. When enabled, the control will not adapt to a changing voltage profile, but will switch around the fixed voltage setpoint, using an adaptive timer.

On this screen the “write” button must be activated after any voltage value is entered (Figure 5, page 14).

F7: Exit

This screen exits the BlinclR® program.

F8: Graph

This screen is only active after a location has been chosen in the list of data (Function F2). See Figure 6 (page 14) for an example of a historical display for the chosen location.

F9: Data

This screen is only active after a location has been chosen in the list of data (Function F2). See Figure 7 (page 14).

F10: Blinc

This key Blincs the M-2501A. This Blinc transmits all data to the laptop from the M-2501A and transmits any new setpoints or operation commands to the M-2501A. (The laptop emits an audible “beep” to verify that communication was completed.)

3.9 Troubleshooting: Laptop

1. Observe the F8 screen. If the reference voltage line (the thick square wave) does not vary, the capacitor bank is not switching properly. Possible problems are:
 - a. A blown fuse in the M-2501A unit. ACC uses an MDA 10 Amp fastblow ceramic case fuse.
 - b. A capacitor bank problem.
 - c. An M-2501A failure.
2. If the F8 screen on the laptop does not display a graph, the unit either re-initialized or had a loss of power. This is not a problem as the unit's operation will not be affected.
3. If H' on the F9 screen is consistently 4000, the bank is cycling frequently. The switch should be monitored frequently for wear or failure due to the high number of switching operations.
4. If the unit will not Blinc:
 - a. Shade the infrared port on the M-2920A BecoEye[®] IR adapter unit from direct sunlight while Blincing.
 - b. Place the BecoEye against the M-2501A infrared port and slowly draw it away from the unit while Blincing.
 - c. If unit still won't Blinc, contact Beckwith Electric.

3.10 Accessories M-2801 BlincIR[®] Communication and Analysis Software: Laptop

M-2801 BlincIR Communication and Analysis software.

Supplied on a 3-1/2 inch disk for direct installation to IBM compatible PC.

M-2920A BecoEye Infrared Communications Adapter

Provides communications between a laptop PC without an infrared port and the M-2501A Autodaptive Capacitor Control.

M-2921 BecoEye 12' extension cable.

M-2922 BecoEye "Y" adapter cable for use with DIN connector.

M-2923 BecoEye 14" Adapter Cable (PS/2 to USB) for use with laptop computers which have only USB connections.

M-2909 Flash Memory (PCMCIA Format) Card

Includes preloaded M-2801 BlincIR Communication and Analysis Software. May be purchased separately.

- a. Fits into PCMCIA type 2 slot on an IBM-compatible PC.
- b. Provides the BlincIR software to an IBM-compatible PC with a PCMCIA interface.
- c. Provides additional capacity for maintaining individual M-2501A Autodaptive[®] Capacitor Controls.

3.11 Manual Operation of the Control Without M-2801 Software

The M-2501A may be manually operated from two front panel switches by removing the Lexan[™] cover (twist counterclockwise to remove).

The **AUTO/MANUAL** switch on the right-hand side of the faceplate is used to place the control in manual mode without the use of M-2801 communication software. If the control is to be successfully operated by the M-2801 software, this switch should be left in the **AUTO** position. Placing this switch in the **MANUAL** position will remove automatic control from the **COM** port. Returning the switch to the **AUTO** position may call for an instantaneous operation, depending on voltage conditions and switch position. Such an operation is subject to a 30 second time delay and a 5 minute delay from a previous **OPEN** operation.

The **OPEN/CLOSE** switch located on the left-hand side of the faceplate operates the output relays in the following manner:

1. The **OPEN** command will activate the **OPEN** Control output for 15 seconds, subject to a 30 second timeout for operator safety.
2. The **CLOSE** command will activate the close control output for 15 seconds, subject to a 5 minute delay from the last **OPEN** operation, and 30 seconds from **CLOSE** command.

NOTE: When replacing Lexan[™] cover, replace and twist firmly in a clockwise fashion, so that the word "top" (printed on the inner shield) is visible at the top of the unit.

4.0 Status LEDs

The Status LEDs located on the bottom front of the control are:

- **AUTOMATIC** – *Yellow* (Lit steadily when control is in automatic mode.)
- **MANUAL** – *Blue* (Lit steadily when control is in manual mode. It may have been placed in this mode by setting the “Auto/Manual” switch to Manual, or by the IR port communications, or both. It will blink for five minutes after an open operation is initiated in the Manual mode.)
- **OPEN** – *Green* (Lit continuously when control believes bank to be open, and during the 15 seconds when a manual close operation is in progress. It will blink for 30 seconds before and 15 seconds after a manual open operation is initiated.)
- **CLOSE** – *Red* (Lit continuously when control believes the bank is closed, and during the 15 seconds that a manual close operation is in progress. It will blink for 30 seconds before and 15 seconds after a manual close operation is initiated.)

The **OPEN** and **CLOSE** LEDs will flash at approximately 1 Hz when a switch to the mode indicated by the flashing LED is pending. They continue to flash for the 15 second output closure, then are lit continuously. The previous LED then shuts off. The **MANUAL** LED flashes at a rate of approximately 1 Hz when the 5 minute delay mode is invoked, following an **OPEN** operation.

The LEDs do not blink in the Automatic mode, when the control is likely to be unattended.

When the control is in the Manual mode, both the **OPEN** and **CLOSE** LEDs may be lit simultaneously, with the blinking LED indicating the pending status mode.

5.0 Screens

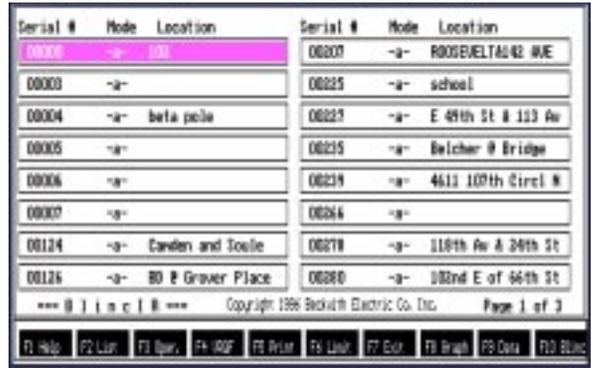


Figure 2 “List” Screen

“List” Screen (F2): This screen lists individual ACC serial numbers with associated locations. Use your keyboard arrow keys to scroll up or down through the list to select the ACC being addressed. Once the correct location is highlighted, press **ENTER**, and then the appropriate function button. Additional locations may be input by pressing F10 and entering a site location. When this screen is displayed on a palmtop computer, a line indicating the battery level (empty to full) will be displayed.



Figure 3 “Operate” Screen

“Operate” (F3): The chosen mode is transmitted to the ACC when the unit is Blincd. Care should be taken to leave the unit in the Automatic mode when operations are complete. While the unit is in Automatic mode or Manual mode, an “a” or an “m” appears on the “List” screen next to the unit name and serial number.

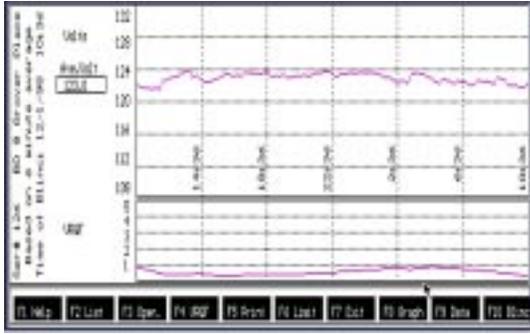


Figure 4 "VRQF" Screen

"VRQF" (F4): This screen displays the VRQF (Voltage Regulation Quality Factor) and the voltage for the last 24 hours. VRQF is the RMS value of the difference between the present voltage and the average voltage of the preceding 24 hours. (See the "Data" screen.) The voltage and VRQF are sampled every cycle and averaged every six minutes. This screen also displays the date and time of the last Blinc, the serial number and the location of the unit. By using the plus (+) key, the user can toggle between two voltage scales: 108–132 volts or 114–126 volts.



Figure 5 "Voltage Limits" Screen

"Limits and Fixed Voltage Setpoint" (F6): The customer-desired upper and lower voltage levels are input from this screen. The initial factory settings are 126 V and 114 V. To change the settings, use the left and right arrow keys to highlight the voltage level field, press Enter, input the new number for the voltage level, and press Enter again. The program will again display the Voltage Limits Screen with the new voltage level indicated. Highlighting the "Fixed Voltage Setpoint" allows any voltage between 98.0–132 Volts and zero volts to be entered. Entering zero volts disables the feature. When a non-zero value is entered, the control will switch around the fixed voltage setpoint, using an adaptive timer. The "Write" button must be high-

lighted after entering new voltage values in any of the three settings on this screen. **NOTE:** There is a 6 V minimum between the upper and lower voltage levels.

After the values have been input, it is necessary to highlight "WRITE" and Blinc the ACC using F10. If the site voltage drifts outside these settings, the ACC will act through the adaptable nonlinear timers to switch the bank if necessary.

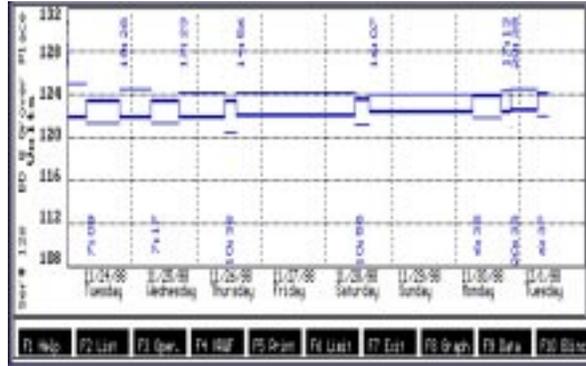


Figure 6 "Graph" Screen

"Graph" (F8): The "Graph" screen displays the previous 16 open and close operation data (up to 8 days). Included are: times of capacitor switching, reference voltages for each time interval, the maximum voltage with capacitors off, and the minimum voltage with capacitors on.

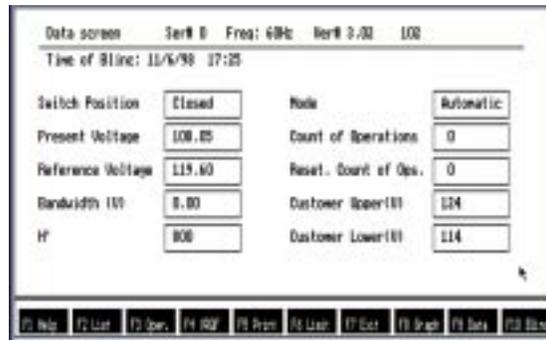


Figure 7 "Data" Screen

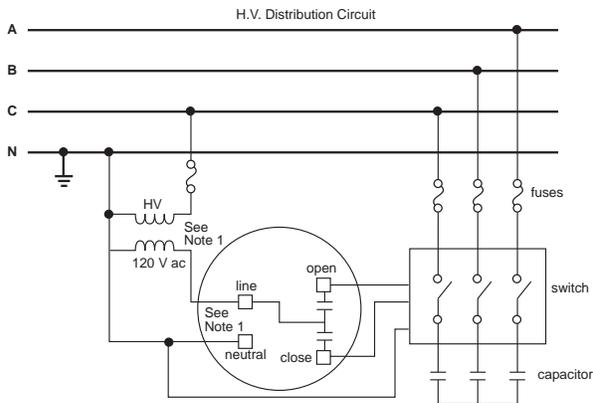
"DATA" (F9): This screen displays all the following values after an ACC has been Blincd: Switch Position (opened or closed), Present Voltage, Reference Voltage, Bandwidth, H' (adaptive time limit-*for factory use only*), Operating Mode, Operations Count, Resettable Operations Count, and Customer-Desired Upper and Lower Voltage Levels. Values will remain until the next time the unit is Blincd, when values are replaced.

6.0 Application Notes

A typical connection diagram for an M-2501A is shown in Figure 8 below.

The following considerations should be given:

1. The M-2501A requires a dedicated VT (voltage source) for control and switch power.
2. The difference between the upper and lower voltage levels must be a minimum of 6V.
3. The M-2501A may not be suitable for use in applications where multiple daily cyclical loads are present.
4. The M-2501A may not be suitable for use in applications where the capacitor bank is placed close to the voltage regulating source when line drop compensation is used.



NOTE:

1. A line-to-line VT with a 120 V ac secondary is also acceptable.

Figure 8 Typical Application of ACC

7.0 Testing

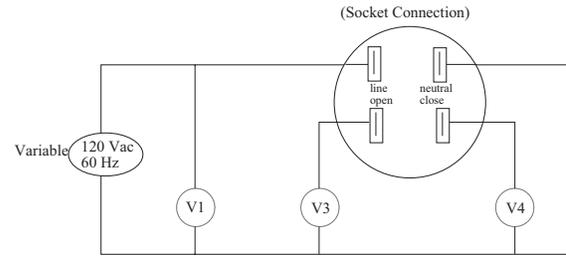


Figure 9 Test Circuit Diagram

Required Equipment

- variable 120V ac source;
- standard meter socket;
- voltmeter;
- electronic timer.

Test Procedure

1. Set V1 = 120V: Voltage V3 and V4 will equal 0V.
2. Initialize the unit: The unit was initialized at the factory with the upper and lower voltage levels set at 126V and 114V respectively. If the unit has been initialized or used in the field, it should be re-initialized before testing with upper and lower voltage levels set at 126V and 114V.
3. Lower V1 to 113V: after 1 second (subject to a 5 minute reclose delay), V4 will equal 113V (for 15 seconds - seal-in) and V3 will remain at 0 V.
4. Raise V1 to 127V: after 1 second, V3 will equal 127V (for 15 seconds – seal-in) and V4 will remain at 0V.



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