CONTENTS

INSTRUCTION MANUAL

FOR

CAPACITOR CONTROL RELAY

Part Number: 9 2483 00 100

Basler Electric

Publication: 9 2483 00 990
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INTRODUCTION

The purpose of this Instruction Manual is to furnish information concerning the operation and installation of this device. To accomplish this, the following is provided.

- **General Information and Specifications**
- **Layout and Connection**
- **Calibration Tests**
- **Mounting Information**

W A R N I N G !

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

First Printing: September 1990

Printed in USA

February 2001

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 Company, Highland, Illinois.

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CONTENTS

SECTION 1 • GENERAL INFORMATION

PURPOSE

The Capacitor Control Relay (CCR) P/N 9 2483 00 100 is an automatic voltage controller. It is used to energize and de-energize capacitor banks used for power system voltage control. Var control is also achieved by switching on capacitor banks to decrease var flow and system losses at locations where var flow is excessive.

GENERAL

The Capacitor Control Relay, functionally shown in Figure 1-1, provides closing and opening of a capacitor bank by monitoring system voltage and a Form B auxiliary contact of the controlled circuit breaker for the capacitor bank.

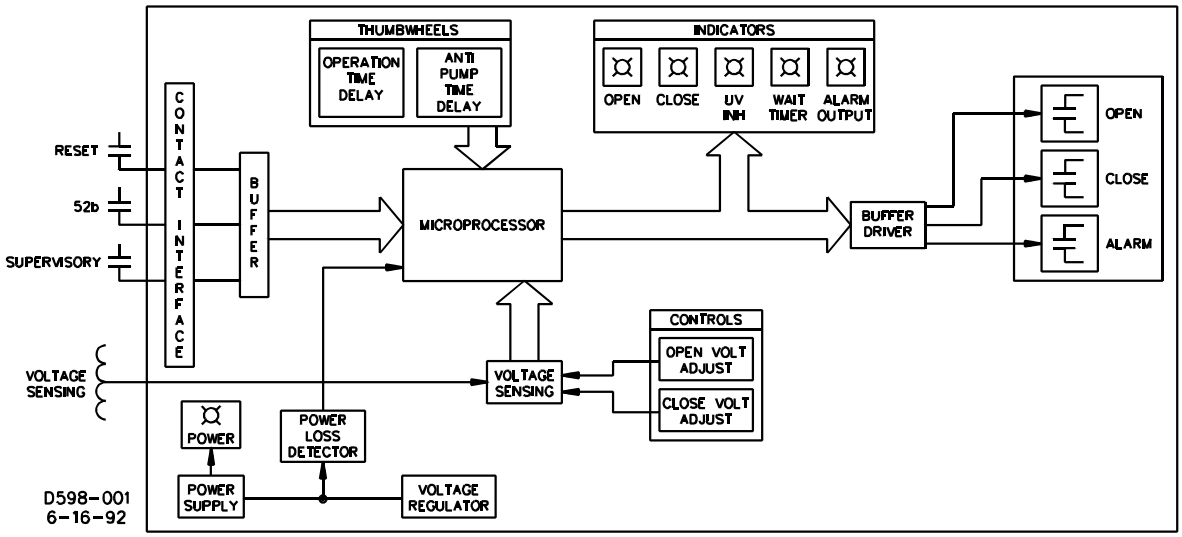

Figure 1-1. Functional Block Diagram

Contact sensing (reset, 52b, supervisory) requires an external power supply of 62 to 150 Vdc to supply direct current to the polarity sensitive relay contact sensing inputs.

Voltage sensing is an input from a single phase 120 Vac nominal (potential transformer). Voltage levels for open and close conditions are determined by front panel continuously adjustable potentiometers. An undervoltage inhibit level is internally set to 80 Vac to limit the bottom range of the open and close conditions.

When voltage sensing is below the UV inhibit level, the front panel UV INH LED and ALARM LED will be illuminated and the NO alarm will be closed.

When an open or close condition exists (the sensing voltage is above the open level or below the close level), the respective front panel OPEN or CLOSE LED will be illuminated.

The front panel adjustable operation time delay will start timing when the open or close condition occurs. Open or close condition must exist for the full programmed time delay before any relay operation. The open or close conditions **will not** overlap or occur at the same time.

Whenever the control breaker for the capacitor bank is opened, (52b input becomes closed) a fixed wait timer will start timing and relay will not allow any closing of the controlled breaker either from a close condition or a supervisory input. The front panel WAIT TIMER LED illuminates to indicate that the wait timer is timing. If a supervisory close input is received while the wait timer is timing, the NO alarm output will close

and front panel ALARM OUTPUT LED will illuminate. After the wait time has expired, the WAIT TIMER and ALARM OUTPUT LED's will be extinguished and the NO alarm output will open. If supervisory close input is still present or is reapplied after wait timer times out, the NO close output will close. The NO close output of the relay will also close if a close condition (low voltage) exists after the wait time delay has expired and the operation time delay has expired for the close condition.

During an open condition (high voltage), the operation time delay will time only while the open condition exists. After the operation time delay times out, the NO open output of the relay will close to open the control breaker for the capacitor bank.

If the control breaker for the capacitor bank fails to change state after receiving an open or close signal from the relay, a fixed fail to operate timer will start timing. If the timer times out, the relay will advance to an alarm state. During the alarm state, the ALARM OUTPUT LED will be illuminated and the NO alarm output will be closed. All other functions will be disabled until the reset contact input to the relay is received.

A front panel adjustable anti-pump time determines the maximum amount of time between three state changes of the control breaker auxiliary contact (52b). If three changes in state occur before the anti-pump timer times out (open-close-open or close-open-close), the relay will advance to the alarm state. The reset input must be energized to return the relay back to normal controlling state.

The relay will not attempt to close an already closed breaker or open an already open breaker.

The following flow chart illustrates the functional operation of the capacitor control relay.

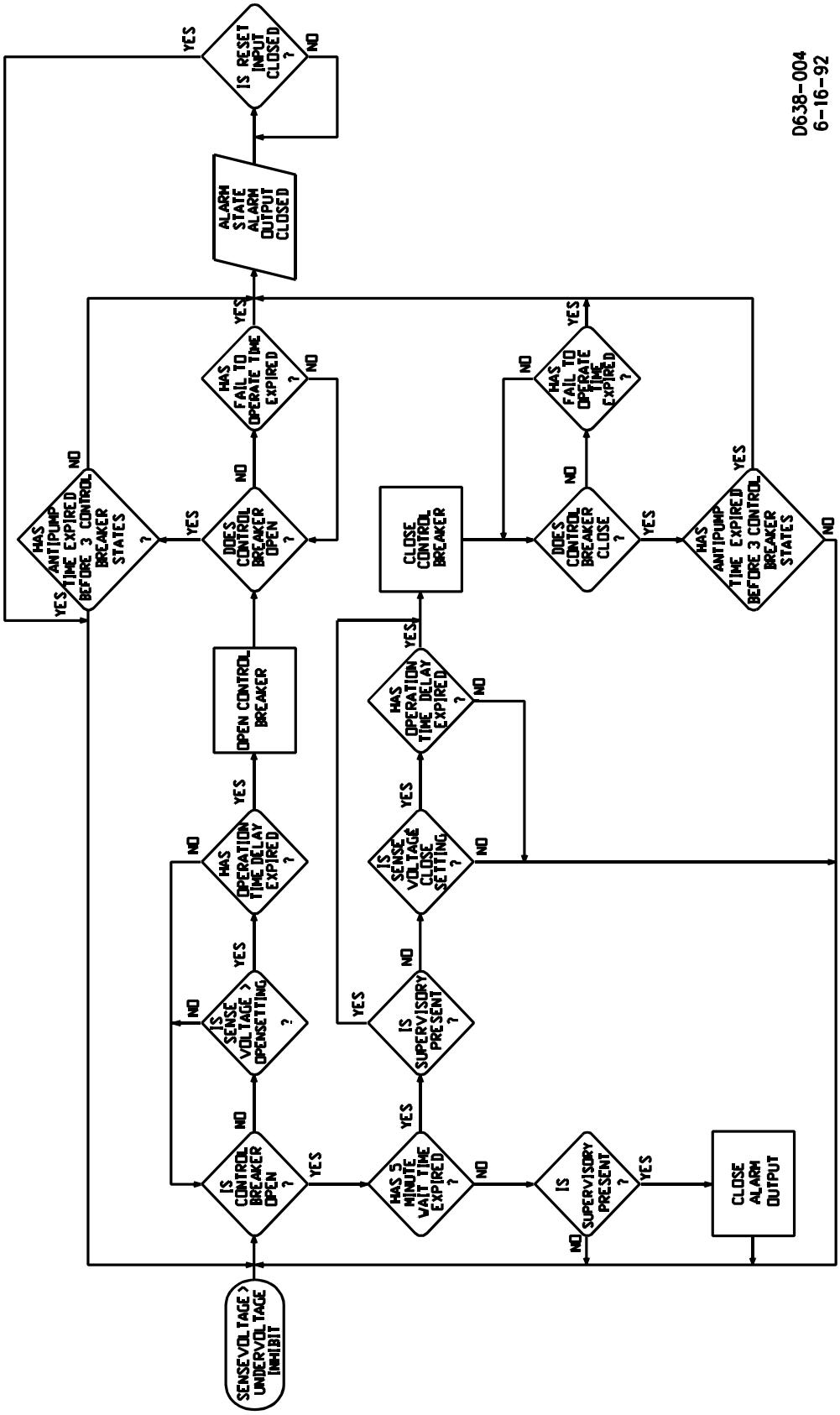

Figure 1-2. Simplified CCR Flow Chart

SPECIFICATIONS

Power Input

Nominal input voltage of 125 Vdc (62 to 150 Vdc range), 19.5W burden at nominal or 120 Vac (90 to 132 Vac range), 36.OVA at nominal.

Voltage Sensing Inputs

Rated for 160 Vac continuous at 40-70 Hz, with a maximum burden of 1 VA.

Output Circuits

Resistive

120/240 Vac Make 30 A for 0.2 seconds, carry 7 A continuously, break 7 A.

125/250 Vdc Make and carry 30 A for 0.2 seconds, carry 7 A continuously, break 0.1 A.

500 Vdc Make and carry 15 A for 0.2 seconds, carry 7 A continuously, break 0.1 A.

Inductive

120/240 Vac, Break 0.3 A, (L/R = 0.04).

125/250

Contact Sensing Reset Supervisory 52b

An applied sensing voltage equal to the relay's dc power supply input rating is required. Burden is .8 Watts at nominal 125 Vdc per input closed. Minimum contact recognition is 100 milliseconds for each input.

Timing

Operation Time Delay

Adjustable from 10 to 1000 seconds in 10 second increments. (00 = 1000 second setting)

Anti-Pump Time Delay

Adjustable from 10 to 1000 seconds in 10 second increments. (00 = 1000 second setting)

Wait Timer

Non-adjustable - 5 minutes.

Fail to Operate Timer

Non-adjustable - 10 seconds.

Undervoltage Inhibit Sensing Selection Range

Internally adjustable over the minimum range 75V to 105 Vac.

Open & Close Voltage Sensing Selection Range

Continuously adjustable over the minimum range of 80 to 160 Vac or from Undervoltage Inhibit setting up to 160 Vac.

Voltage Sensing Measuring Accuracy

±2% of pickup setting.

Time Delay Accuracy

±5% of time dial setting or 50 milliseconds, whichever is less. Time delay repeatability is within ±2% of setting at 25°C.

Isolation

1500 Vac at 60 Hz for one minute (Dielectric Test).

Surge Withstand Capability	Qualified to ANSI/IEEE C37.90a-1974.
Operating temperature	-40°C (-40°F) to +70°C (+158°F).
Storage temperature	-65°C (-85°F) to +100°C (+212°F).
Shock	In standard tests, the relay has withstood 15 g in each of three mutually perpendicular axes without structural damage or degradation of performance.
Vibration	In standard tests, the relay has withstood 2 g in each of three mutually perpendicular axes swept over the range of 10 to 500 Hz for a total of six sweeps, 15 minutes each sweep, without structural damage or degradation of performance.
Weight	13.0 pounds maximum net.
Case Size	S1

SECTION 2

LAYOUT AND CONNECTION

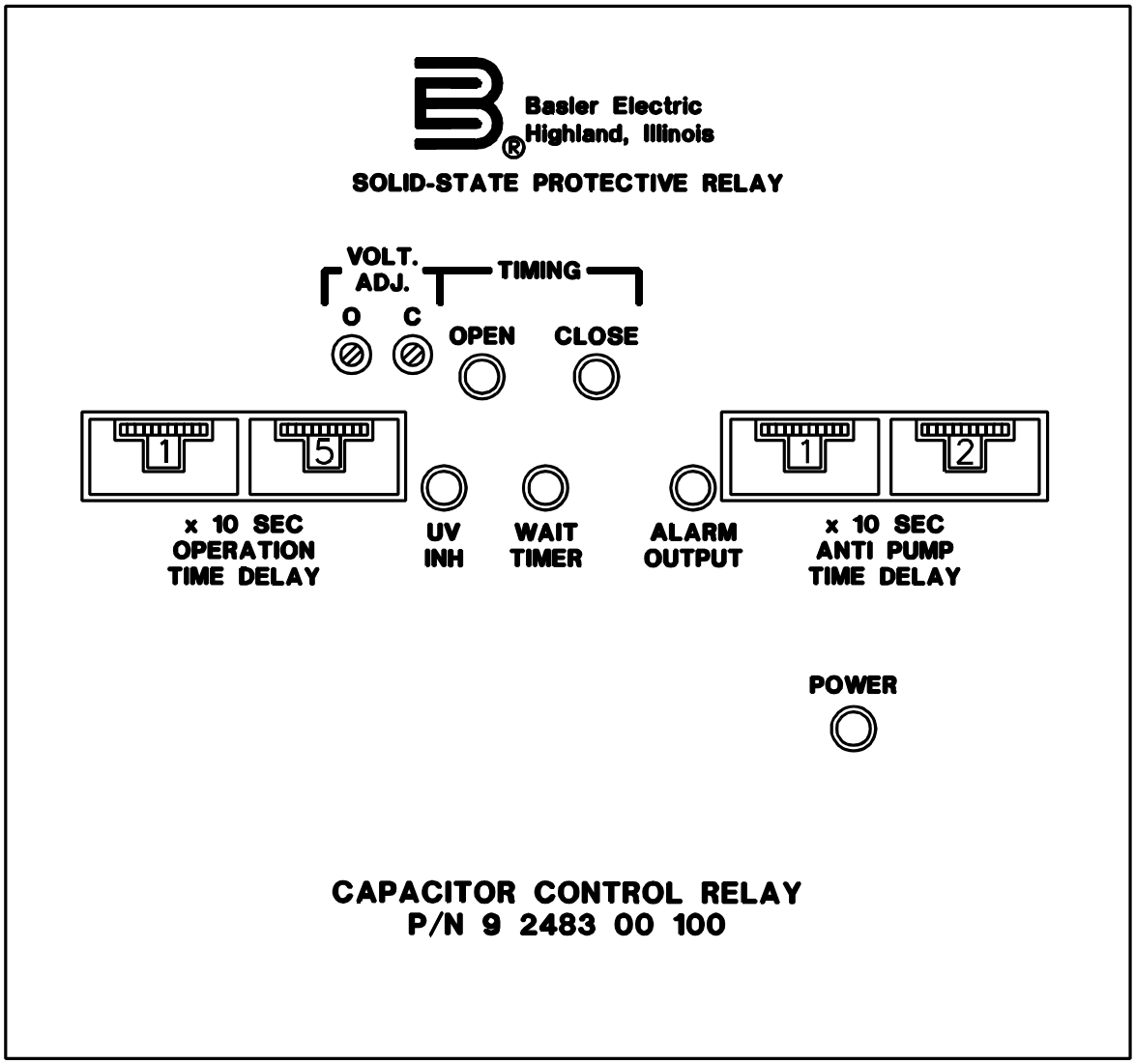

Figure 2-1. Front Panel Layout.

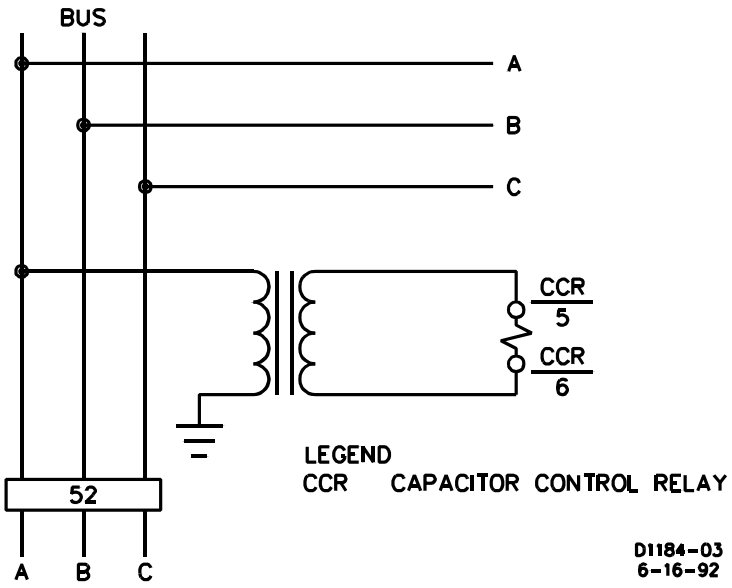

Figure 2-2. Typical Input Connections.

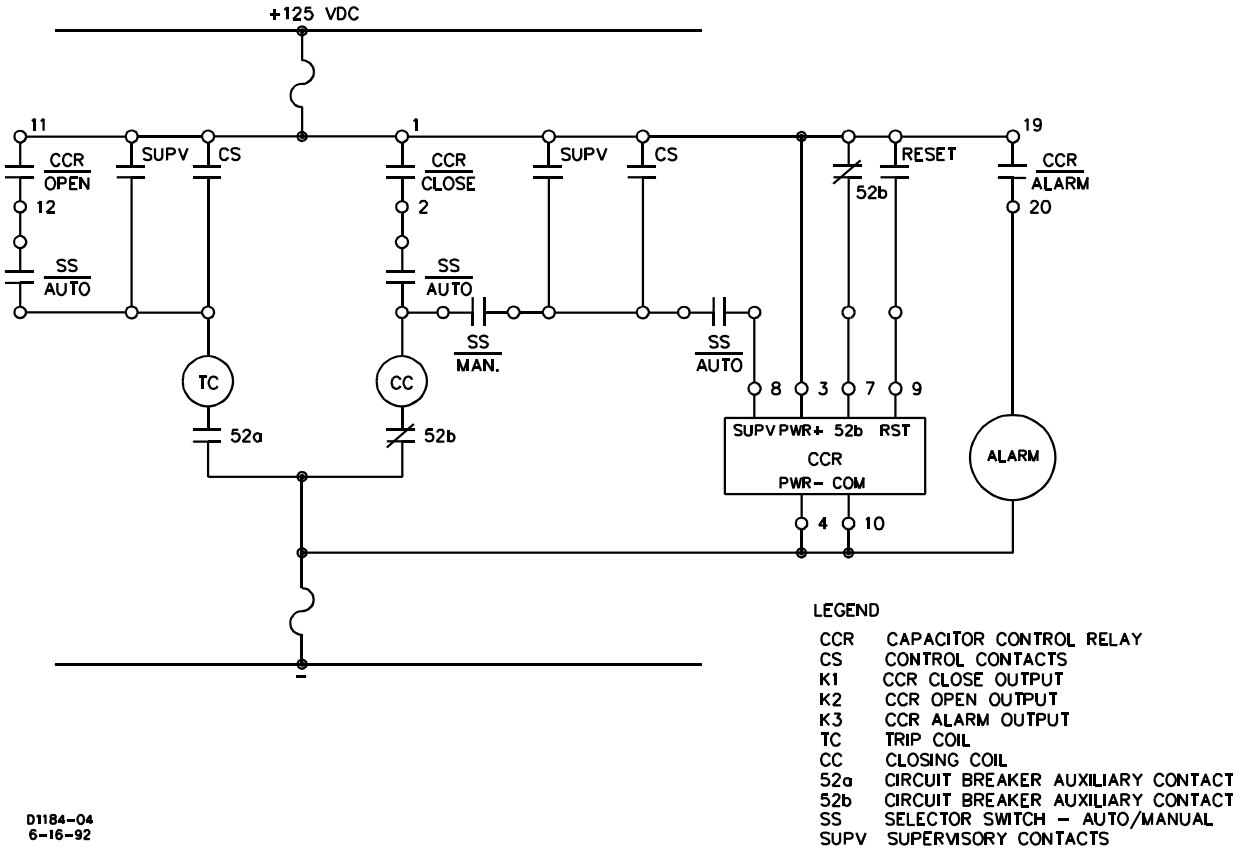

Figure 2-3. Typical Control Connections.

SECTION 3

TEST AND CALIBRATION

CALIBRATION TEST PROCEDURE

The following procedure verifies hardware operation of the relay. Tolerances of test equipment must be taken into account when checking results.

STEP 1. Connect variable power source, latching relay, and switches as shown in Figure 3-1.

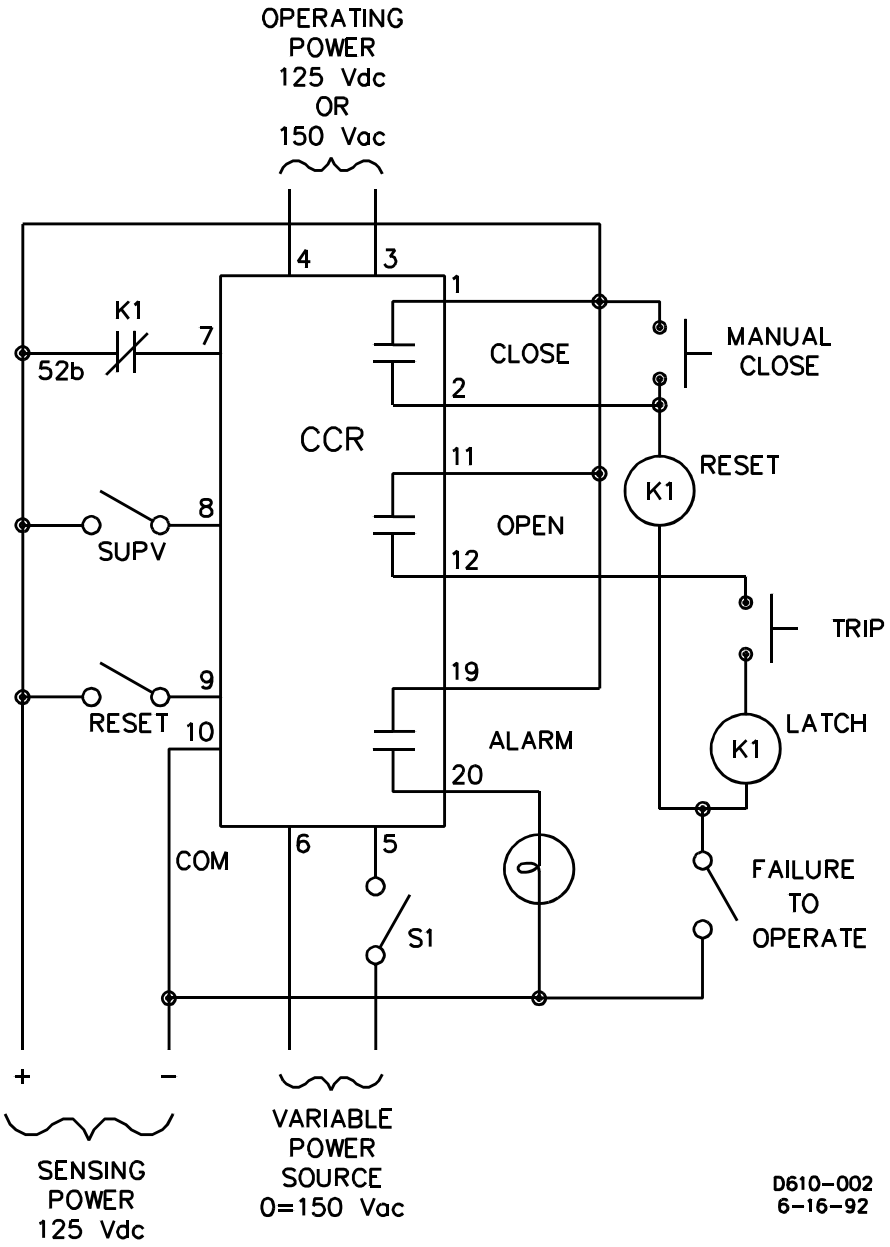

Figure 3-1. Calibration Test Circuit

STEP 2. Adjust front panel VOLT. ADJ. O control fully CW and C control fully CCW.

STEP 3. Apply nominal operating power. Alarm output contacts pulse for 250 milliseconds and remain closed. ALARM OUTPUT LED will be illuminated.

STEP 4. Close S1 and apply variable power source until UV INH LED extinguishes. ALARM OUTPUT LED extinguishes and alarm output opens. This undervoltage inhibit level may be adjusted using R64 on the analog board.

STEP 5. Increase variable power source to the desired close voltage setting. Adjust front panel VOLT. ADJ. C control CW until the CLOSE LED extinguishes. Vary power source to verify close setting.

STEP 6. Increase variable power source to the desired open voltage setting. Adjust front panel VOLT. ADJ. O control CCW until the OPEN LED illuminates. Vary power source to verify open setting.

STEP 7. Increase variable power source so that the OPEN LED is illuminated. Open S1.

STEP 8. Set front panel thumbwheels OPERATION TIME DELAY and ANTI-PUMP TIME DELAY to 01.

STEP 9. Connect timer/counter start input to terminal 20 (alarm output) and terminal 10 (common). Connect timer/counter stop input to terminal 12 (open) and terminal 10 (common).

STEP 10. Close FAILURE TO OPERATE switch and ensure 52b input is open by pressing momentary MANUAL CLOSE pushbutton.

STEP 11. Close S1 and measure the time from when terminal 20 goes low (alarm output) until terminal 12 goes high (open output). Time should be 10 seconds ±5%. (Operation time delay.)

STEP 12. Momentarily press the manual close pushbutton to open 52b input.

STEP 13. Open FAILURE TO OPERATE switch and S1.

STEP 14. Connect timer/counter start input to terminal 12 (open) and terminal 10 (common). Connect timer/counter stop input to terminal 20 (alarm) and terminal 10 (common).

STEP 15. Close S1, allow operation time delay to expire and measure the time from when terminal 12 (open output) goes high until terminal 20 (alarm output) goes high. Time should be 10 seconds ±5% for the Fail-To-Operate Time Delay. OPEN LED will be extinguished and ALARM OUTPUT LED will be illuminated and alarm output will be closed.

STEP 16. Connect timer/counter start to terminal 7 (52b input) and stop to terminal 2 (close output) and terminal 10 (common).

STEP 17. Close terminal 9 input (reset). Alarm output will open and ALARM OUTPUT LED will extinguish. OPEN LED will be illuminated.

STEP 18. Adjust variable power source until CLOSE LED illuminates. Close 52b. Measure time from when 52b goes high until close output closes. Time should be 5 minutes ±5% for the wait timer.

STEP 19. Adjust variable power source until both the OPEN and CLOSE LEDs are extinguished.

STEP 20. Push TRIP switch, then MANUAL CLOSE then TRIP switch again within 10 seconds. ALARM OUTPUT will be illuminated and alarm output will be closed.

STEP 21. Close RESET switch. ALARM OUTPUT LED will extinguish and alarm output will open.

STEP 22. Repeat Step 20, but allow more than 10 seconds from when the TRIP switch is pushed the first time until when the TRIP switch is pushed the second time. ALARM OUTPUT LED will remain extinguished and alarm output will remain open.

STEP 23. Open S1 and remove operating power. Return front panel thumbwheels to their normal service operation conditions and return relay to service.

QUICK TEST

STEP 1. Place the normal/test switch (on the logic board) to the TEST position.

STEP 2. Set OPERATION TIME DELAY thumbwheels to any setting except 00. (00 will cause all outputs and LEDs to sequence on and off.)

STEP 3. Apply nominal operating power. Alarm output will pulse for 250 milliseconds and remain closed. ALARM LED will be illuminated.

NOTE
Close Output and Alarm Output will be closed to indicate test mode.

STEP 4. Apply variable power source to verify open and close conditions. Each condition will also close their respective outputs.

STEP 5. Close any input (reset, supervisory, or 52b). The WAIT TIMER LED will illuminate when the selected input is closed.

STEP 6. Close the 52b input. The Anti-pump time delay will start timing with value of front panel setting. The open output will close when the anti-pump time delay times out.

STEP 7. Open 52b input and close the reset input. The open output will open.

STEP 8. Close the supervisory input. The operation time delay will start timing with the value of the front panel setting. The open output will close when the operation time delay times out.

STEP 9. Open supervisory input and close the reset input. The open output will open.

STEP 10. Remove variable power source. UV INH LED, ALARM LED, and CLOSE LED will be illuminated. Alarm output and close output will be closed.

STEP 11. Remove operating power. Return the normal test switch (on logic board) to the normal position.

STEP 12. Return front panel thumbwheels to their normal service operation conditions and return relay to service.

SECTION 4

INSTALLATION

GENERAL

When not shipped as part of a control or switchgear panel, the relays are shipped in sturdy cartons to prevent damage during transit. Immediately upon receipt of a relay, check the model and style number against the requisition and packing list to see that they agree. Visually inspect the relay for damage that may have occurred during shipment. If there is evidence of damage, immediately file a claim with the carrier and notify the Regional Sales Office, or contact the Sales Representative at Basler Electric, Highland, Illinois.

In the event the relay is not to be installed immediately, store the relay in its original shipping carton in a moisture and dust free environment. When relay is to be placed in service, it is recommended that the calibration test procedure in Section 3, be performed prior to installation.

RELAY OPERATING PRECAUTIONS

Before installation or operation of the relay, note the following precautions:

1. The relay is a solid-state device. If a wiring insulation test is required, remove the connection plugs and withdraw the cradle from its case.

2. When the connection plugs are removed the relay is disconnected from the operating circuit and will not provide system control. Always be sure that external operating (monitored) conditions are stable before removing a relay for inspection, test, or service.

5. Be sure the relay case is hard wired to earth ground using the ground terminal on the rear of the unit. It is recommended to use a separate ground lead to the ground bus for each relay.

DIELECTRIC TEST

In accordance with IEC 255-5 and ANSI/IEEE C37.90-1989, one-minute dielectric (high potential) tests up to 1500 Vac (45-65 Hz) may be performed.

MOUNTING

Because the relay is of solid state design, it does not have to be mounted vertically. Any convenient mounting angle may be chosen. Relay outline dimensions and panel drilling diagrams are supplied at the end of this section.

CONNECTIONS

NOTE

Be sure the relay case is hard-wired to earth ground with no smaller than 12 AWG copper wire attached to the ground terminal on the rear of the relay case. When the relay is configured in a system with other protective devices, it is recommended to use a separate lead to the ground bus from each relay.

Except as noted above, connections should be made with minimum wire size of 14 AWG.

To prevent an inductive overload of the relay contacts, break the trip circuit externally through the 52a contacts (refer to Figure 2-3).

System wiring connects to the case terminals through a connection plug. Removing the connection plug opens all normally open contacts before opening the power and sensing circuits.

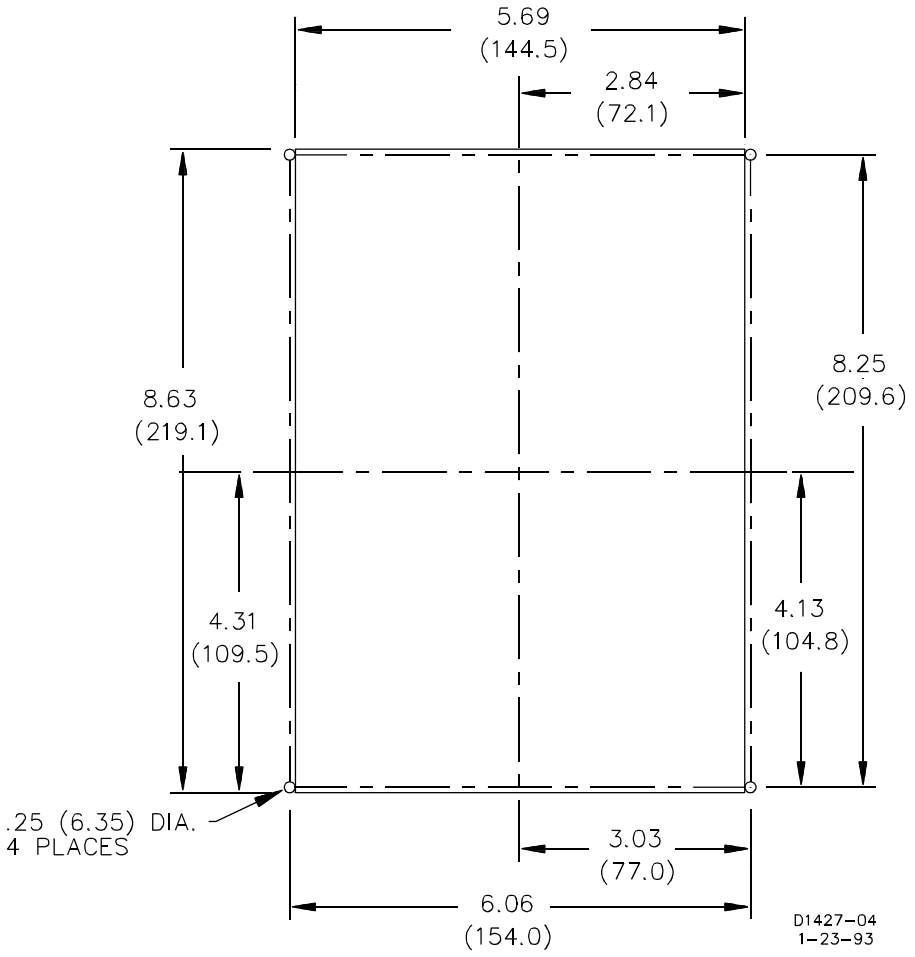

Figure 4-1. S1 Case, Panel Drilling Diagram, Semi-Flush Mounting

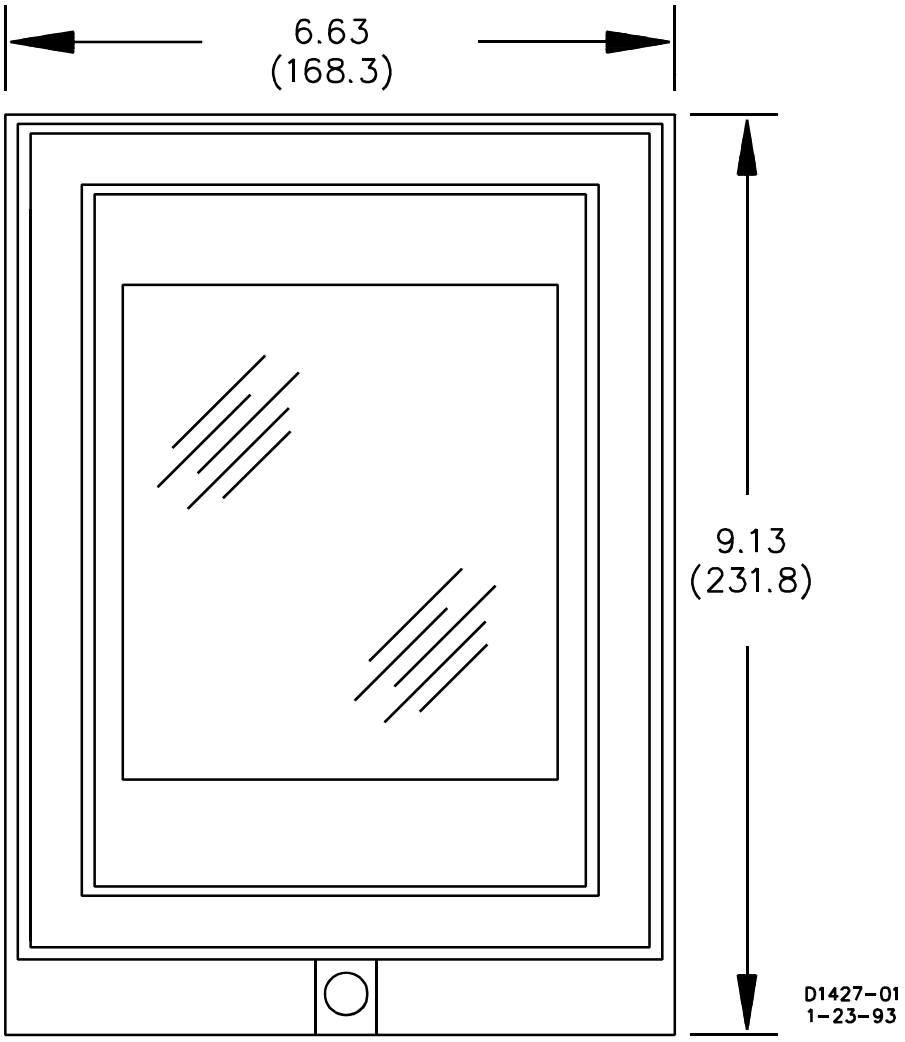

Figure 4-2. S1 Case, Outline Dimensions, Front View

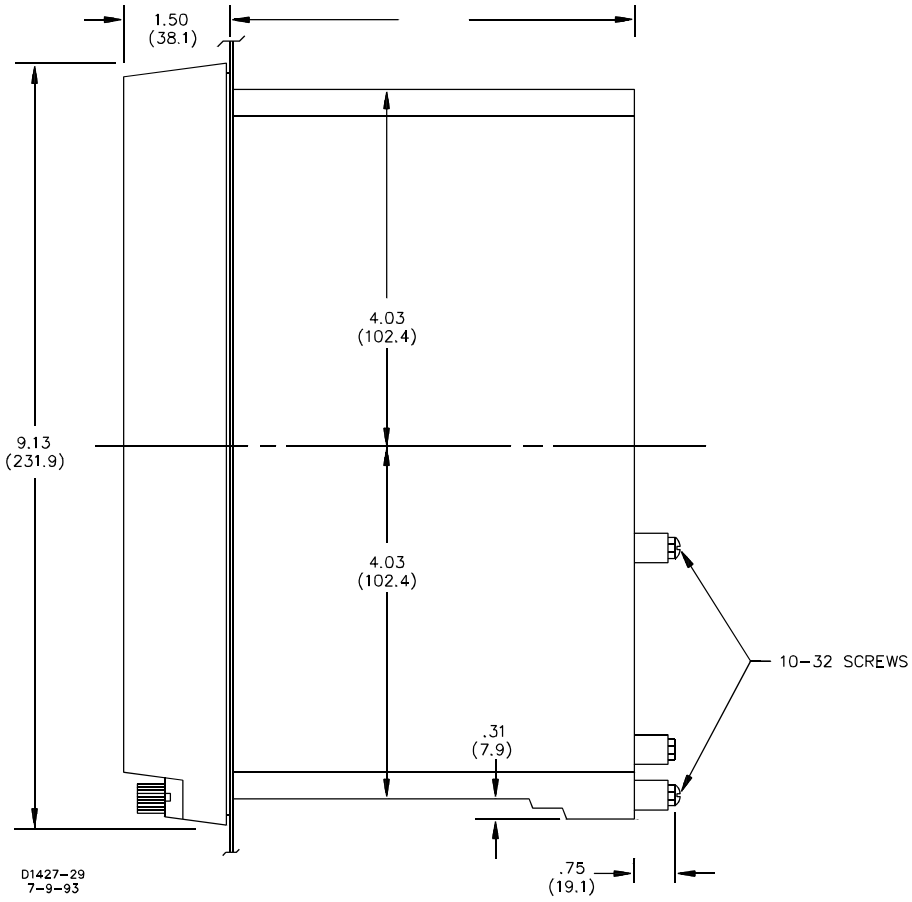

Figure 4-3. S1 Case, Single-Ended, Semi-Flush Mounting, Side View

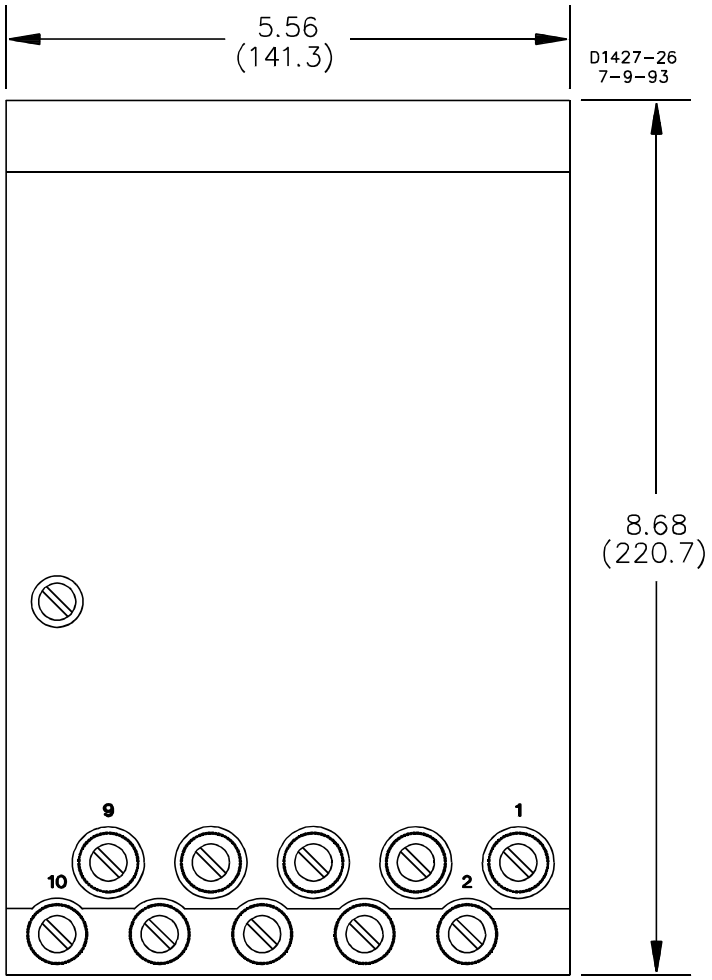

Figure 4-4. S1 Case, Single-Ended, Semi-Flush Mounting, Outline Dimensions, Rear View

SECTION 5

MAINTENANCE

GENERAL

Capacitor Control Relay requires no preventive maintenance other than a periodic test. The procedures in Section 3 provide test and calibration instructions. If the relay fails to function properly, and in-house repair is contemplated, consult the Service Manual (publication number 9 1702 00 620). If factory repair is desired, contact the Customer Service Department of the Power Systems Group, Basler Electric, for a return authorization number prior to shipping.

IN-HOUSE REPAIR

In-house replacement of individual components may be difficult and should not be attempted unless appropriate equipment and qualified personnel are available.

CAUTION

Substitution of printed circuit boards or individual components does not necessarily mean the relay will operate properly. Always test the relay before placing it in operation.

If in-house repair is to be attempted, component values may be obtained from the schematics or the parts list of the Service Manual. Replacement parts may be purchased locally. The quality of replacement parts must be at least equal to that of the original components.

Where special components are involved, Basler Electric part numbers may be obtained from the number stamped on the component or assembly, the schematic, or parts list. These parts may be ordered directly from Basler Electric. When complete boards or assemblies are needed, the following information is required.

1. Relay model and style number
2. Relay serial number
3. Board or assembly
   a) Part number
   b) Serial number
   c) Revision letter
4. The name of the board or assembly.

STORAGE

This protective relay contains aluminum electrolytic capacitors which generally have a life expectancy in excess of 10 years at storage temperatures less than 40°C. Typically, the life expectancy of the capacitor is cut in half for every 10°C rise in temperature. Storage life can be extended if, at one-year intervals, power is applied to the relay for a period of thirty minutes.

SECTION 6

MANUAL CHANGE INFORMATION

Substantive changes in this manual to date are summarized below.

Revision	Summary of Changes
A	