BECKWITH ELECTRIC

CONTROLS

LTC Backup Control M-0329B

- Prevents a defective LTC tapchanger control from running the voltage outside the upper or lower limits
- Prevents the line drop compensator from raising the voltage too high under full or overload conditions
- Fully transient protected and operates within ±1% voltage accuracy over a temperature range of -40° to +80° C
- Includes First Customer Protection

HUBBELL

Introduction

The M-0329B Backup Control offers reliable voltage protection from both improperly set and malfunctioning Tapchanger controls. The most common voltage error in setting tapchanger controls occurs when values of Line Drop Compensation are set in the tapchanger control that result in unexpectedly high voltage at the transformer due to higher than anticipated load currents.

Modern digital tapchanger controls typically offer Upper and Lower Voltage Limits in the form of Block Raise and Block Lower Setpoints, and can provide runback, as in the M-0329B. However, the M-0329B is a stand-alone, line voltage operated, analog device that keeps operating regardless of the condition of the main control's processor and/ or internal power supply.

The M-0329B has bandcenter and bandwidth settings, similar to the primary tapchanger control. In the majority of applications, the bandcenter should be set to the same numerical voltage value as the primary control. The bandwidth of the M-0329B should be set to at least twice the numerical value of the bandwidth setting of the primary control. The band edges of the M-0329B's bandwidth are the Upper and Lower Voltage Limits, (also known as Block Raise and Block Lower), beyond which, the M-0329B prohibits Raise and Lower commands from the primary control from energizing the tapchanger motor.

The M-0329B also has a "Deadband" setting. This is a voltage band of 1, 2, 3, or 4 Volts, and this value is selected by setting dip switches on the side of the M-0329B. The lower edge of the Deadband setting begins at the Upper Voltage Limit of the M-0329B. The upper edge of the Deadband is referred to as the "Voltage Runback Threshold". When the measured voltage exceeds this threshold due to load shedding or some other external event (the tapchanger is already blocked at this point), the M-0329B can issue its own Lower command. How quickly this occurs is determined by the time delay setting on the M-0329B, which is settable from 1 to 30 seconds. Once this Force Lower command is issued, the M-0329B will not cancel the command until the measured voltage is below the upper edge of the Deadband (Voltage Runback Threshold).

If, for some reason, the voltage remains above the Voltage Runback Threshold (an inoperative tapchanger), the M-0329B will time out for 180 seconds (3 minutes) and then close an Over-Voltage Alarm contact. It may be helpful in setting the M-0329B to adjust the bandwidth setting and Deadband such that the Voltage Runback Threshold matches the maximum allowed system voltage, so that the over-voltage alarm corresponds with the actual maximum value.

It is also helpful to consider setting the M-0329B bandwidth to accommodate the maximum amount of anticipated Voltage Reduction (if used). To accommodate the maximum voltage reduction and the maximum allowable voltage, it is sometimes necessary to skew the bandcenter setting of the M-0329B to accommodate both. Consult the factory if you are unsure how to determine the value for a skewed bandcenter.

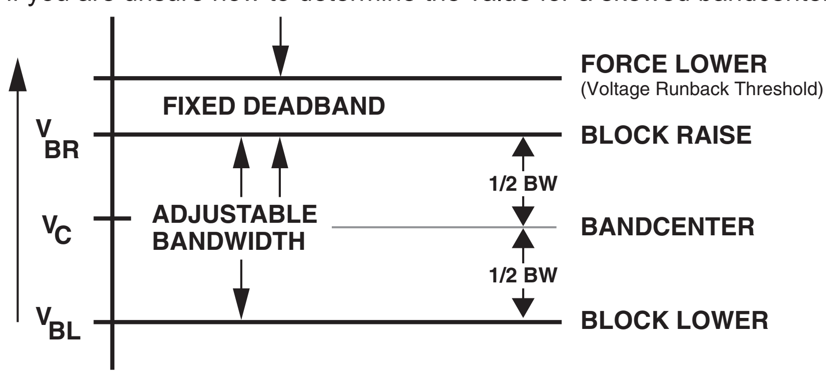


Figure 1 Voltage Level Setpoint Diagram

Features

Block Raise and Block Lower voltage levels are set by accurately calibrated **Bandcenter** and **BANDWIDTH** controls, similar to those found on LTC transformer controls.

BLOCK RAISE/LOWER and **LOWER** LEDs indicate backup control status.

Block Raise, Block Lower, Lower and Alarm contacts provide outputs to drive external components.

Inputs

Power: 90 to 140 Vac, 50/60 Hz, 2 W at 120 Vac

Voltage: Less than 0.2 VA burden at 120 Vac input

Front Panel Controls

BANDWIDTH VOLTS: An accurately calibrated dial adjusts the bandwidth between Block Raise and Block Lower from 6 V to 24 V for 120 Vac.

BANDCENTER VOLTS: An accurately calibrated dial adjusts the Bandcenter from 100 V rms to 140 V rms which allows the M-0329B to operate with most transformer controls.

TIME DELAY SECONDS: Adjustable from 1 to 30 seconds. If the voltage remains above the Block Raise Limit setting longer than the Time Delay setting, the M-0329B will initiate a tapchanger operation to lower the voltage. The Block Raise Limit is defined as the Block Raise setting plus the Deadband value.

Selectable Deadband: The deadband is the voltage range above the Block Raise Level where no tapchanger raise operation will take place. In the M-0329B, it is selectable as 1, 2, 3, or 4 V rms. When the measured voltage is above the Block Raise Limit plus the deadband, the M-0329B will issue a Lower command, after the set Time Delay has expired.

Terminals: Barrier Strip with 8 to 32 screws

LED Indicators

The **BLOCK RAISE/LOWER** LED will light to indicate when the voltage is outside the band.

The **LOWER** LED will light when the voltage exceeds the Block Raise Limit and the Time Delay setting.

Output Contacts

Output Contacts: Contacts are rated at 2 A at 120 Vac.

Blocking Contacts: Contacts will operate within 0.2 seconds after a voltage excursion to prevent the transformer control from causing another tapchange.

Alarm Contacts: After a fixed 3 minute time delay, if the voltage excursion is still present, the alarm is activated to indicate control failure.

Environmental

Temperature Range: Operates within ±1% voltage accuracy as per the following:

IEC 68-2-1	-40° C	96 hour duration
IEC 68-2-2	+80° C	96 hour duration
IEC 68-2-3	+40° C	93%$_{RH}$ 96 hour duration

Fungus Resistance: A conformal printed circuit board coating inhibits fungus growth.

Transient Protection

Input and output circuits are protected against system transients. The M-0329B will pass all the requirements of ANSI/IEEE C37.90.1-1989, which defines oscillatory and fast transient surge withstand capability. All inputs and outputs will withstand 1500 Vac to chassis or instrument ground for one minute. Voltage inputs are electrically isolated from each other, from other circuits, and from ground.

All faces of the relay, with the chassis solidly grounded, have been exposed to Radio Frequency Immunity testing and have successfully passed with a field intensity of 20 V per meter at typical utility frequencies of 144 MHz, 438 MHz, and at 450 MHz.

Physical

Size: 5–3/4" high x 8–3/4" wide x 3–1/2" deep (14.6 cm x 22.2 cm x 8.9 cm)

Approximate Weight: 3 lbs (1.4 kg)

Approximate Shipping Weight: 5 lbs (2.3 kg)

Patent & Warranty

The M-0329B LTC Backup Control is covered by a five year warranty from date of shipment.

Installation

The mounting and outline dimensions are shown in Figure 2, and the external connections in Figure 3.

The M-0329B can be connected as a two-terminal device, by paralleling the Power Input (TB1-1 to TB1-2) and the Voltage (Sensing) Input (TB1-3 to TB1-4). With this connection, the **BANDCENTER** and the **BANDWIDTH** controls can be set so that an upper voltage and a lower voltage limit are established at the desired levels.

On controls where compensated voltage from the line drop compensator is available, the M-0329B can be connected as a four-wire device. The Power Input should be connected to a 120 Vac source and the Voltage Input is then connected to the LDC compensated voltage.

Since sudden changes in the transformer primary voltage may move the secondary voltage outside the range of the LTC control and the M-0329B, a 3 minute timer is provided to allow a normal control to correct the voltage. After 3 minutes of abnormal voltage, the M-0329B **ALARM** contact will indicate an abnormal condition. The **BLOCK RAISE/LOWER** LED will be on, the **ALARM** relay contacts TB1-14 to TB1-15 will be closed and TB1-15 to TB1-16 will be open. The **ALARM** contacts will also indicate an alarm condition if the ac power to the M-0329B fails.

The **ALARM** contacts should be used to alert system operators that a problem has occurred and that the LTC transformer or regulator is not operating. It must be recognized that the **ALARM** contacts may operate under conditions of heavy load using the two-wire connections and the line drop compensator.

The output blocking contacts should be connected in series with the raise and lower contacts from the LTC control. In some control circuits, a timing relay is used. There, the blocking contacts should be in series with the timing relay contacts. The blocking relay contacts should not be connected to drop out the motor starter relay once it is sealed in for a tapchange, since most tapchangers should not be stopped until the tapchange is completed. An exception to this is a spring-driven tapchanger that may be stopped at any time. Figure 5 shows the connections for using the M-0329B with most of the Beckwith Tapchanger and Regulator Controls.

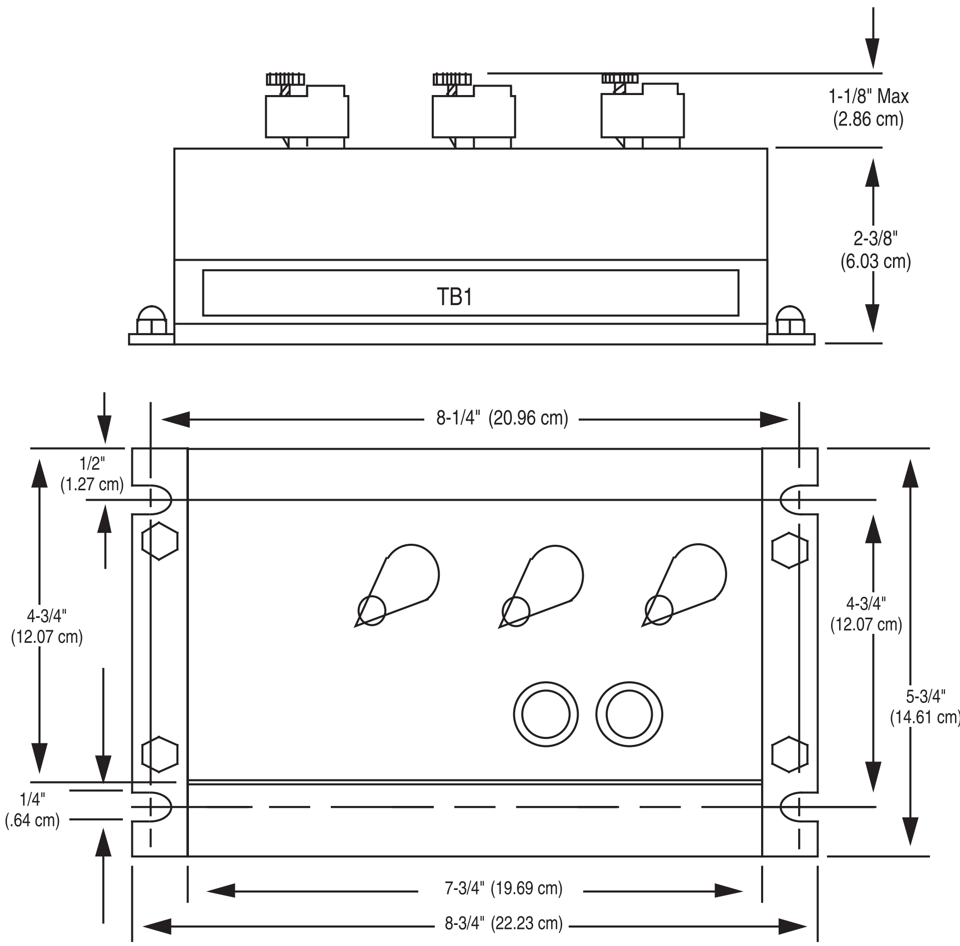


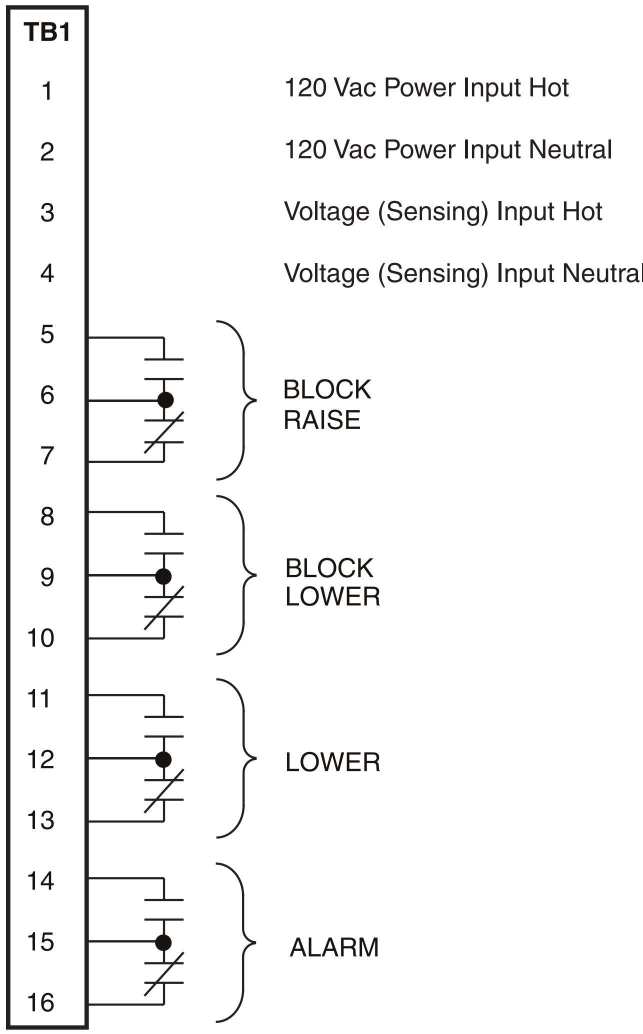
Figure 2 Mounting and Outline Dimensions

External Connections

The M-0329B LTC Backup Control is listed to UL Standards for Safety by Underwriters Laboratories Inc. (UL). To fulfill the UL requirements, terminal block connections must be made with No. 16 AWG wire inserted in an AMP #51864-1 (or equivalent) connector.

Torque Requirements

Both screws must be tightened to 16 inch-pounds torque.



■ **NOTE:** All contacts are shown in the inactive (normal) condition, i.e. the output contact between TB1-14 and TB1-15 is open for the No Alarm condition and will close to indicate an Alarm Condition.

Figure 3 External Connections

Application

The M-0329B can be used in many applications not related to LTC backup for a very accurate overvoltage and/or undervoltage relay. The Block Raise (BLK R) and the Block Lower (BLK L) outputs can be used as overvoltage and undervoltage outputs, respectively.

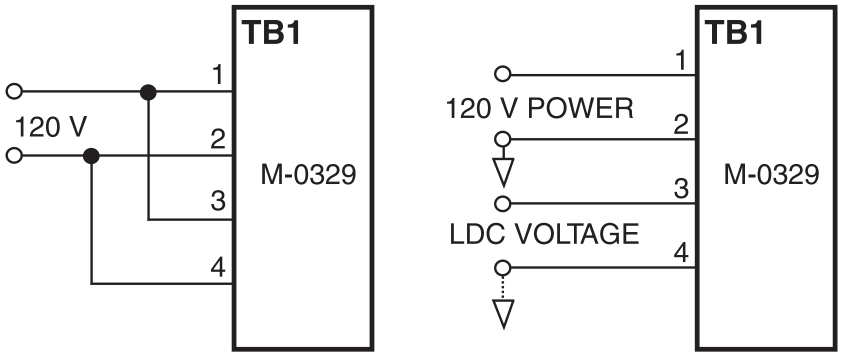


Figure 4 M-0329B Power and Voltage Input Connections

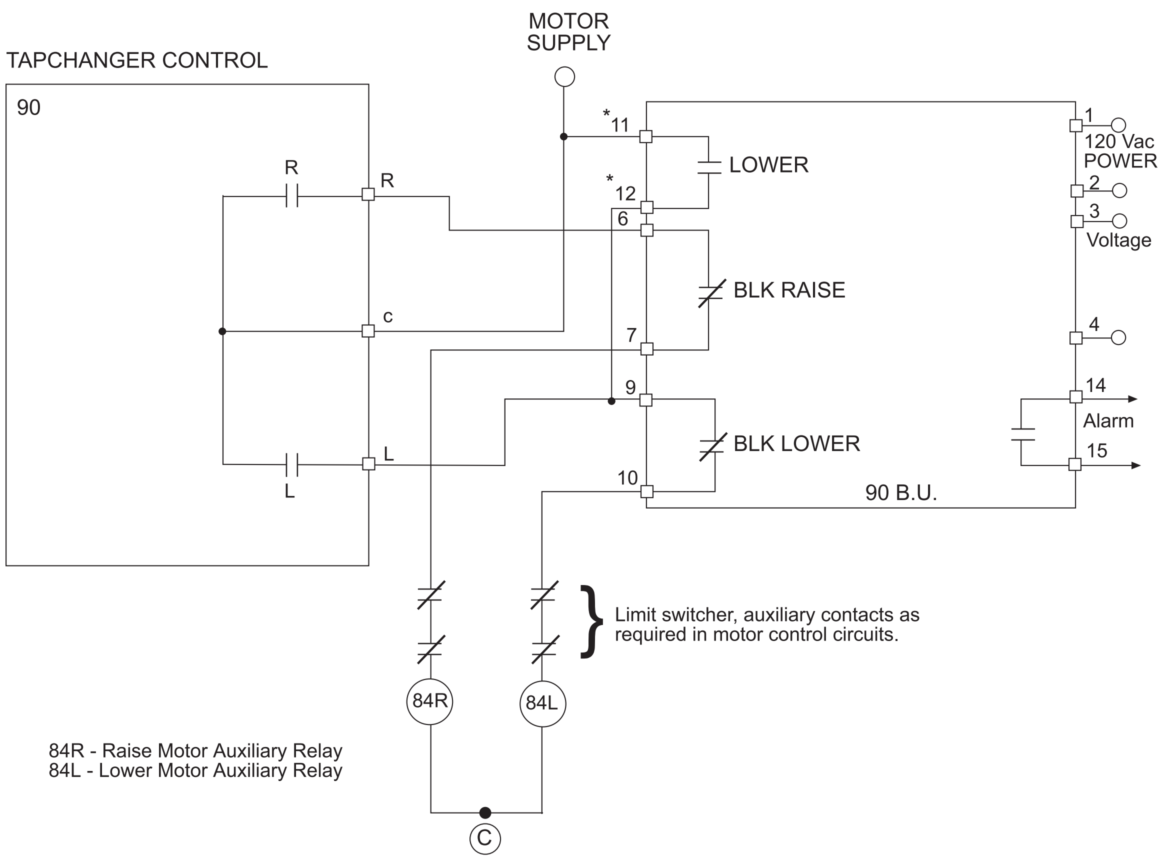


Figure 5 M-0329B Interconnections with Beckwith Tapchanger Control and Regulator

Adjustment

Accurately calibrated dials, labeled **BANDCENTER** and **BANDWIDTH**, set the Block Raise and Block Lower voltage levels. The dials on the M-0329B cover are calibrated in volts for use with 120 Vac nominal voltage.

The following equations will assist the user in choosing the correct setpoints for the M-0329B:

V_{BR} = the Upper Voltage Limit (Block Raise) desired

V_{BL} = the Lower Voltage Limit (Block Lower) desired

The Base Voltage is 120 Vac

The Bandcenter Voltage:

$$V_{BC} = \frac{V_{BR} + V_{BL}}{2}$$

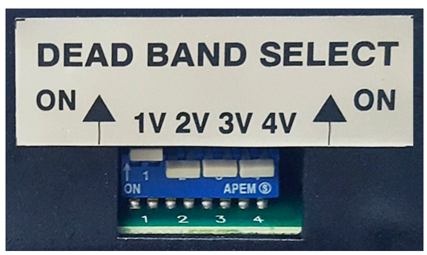
The Bandwidth:

$$V_{BW} = V_{BR} - V_{BL}$$

Selectable Deadband

The deadband is selected on dipswitch S1. There is an opening on the side of the unit providing access to S1. The default position is 1 V, as shown in Figure 6.

When position 1 is up and positions 2, 3, and 4 are down, the deadband selection is 1 V. When position 2 is up and positions 1, 3, and 4 are down, the deadband selection is 2 V. See Table 1.



■ **NOTE:** Switch S1 shown in default position 1V. If more than one switch is in the "up" position, the control's operation and deadband setting will be unpredictable.

Figure 6 Switch S1 Selectable Deadband

	Switch S1 Position			
Deadband Setting	S1-1V	S1-2V	S1-3V	S1-4V
1V	UP	Down	Down	Down
2V	Down	UP	Down	Down
3V	Down	Down	UP	Down
4V	Down	Down	Down	UP

Table 1 Switch S1 Position Settings

Test Procedure

Test Setup

Make the electrical connections as required in Figure 7. The functional indicator lamps are suggested to facilitate testing and can be eliminated if other methods are used.

Equipment Required

1. A stable 60 Hz source with fixed 120 V rms and proper load regulation so that the amplitude does not change more than 0.05 V rms when the relays are energized or the functional indicator lamps are on.
2. A variac, 0 to 140 V adjustable transformer.
3. A high impedance true rms digital multimeter with an ac accuracy of at least ±0.02% of reading, Fluke 45 or equivalent.
4. Solder sucking syringe or solder wick.
5. Soldering iron - Weller Controlled Output Soldering Station Model MTCPL, 60 W, 120 V, 50/60 Hz or equivalent with grounded tip.
6. An accurate stopwatch.

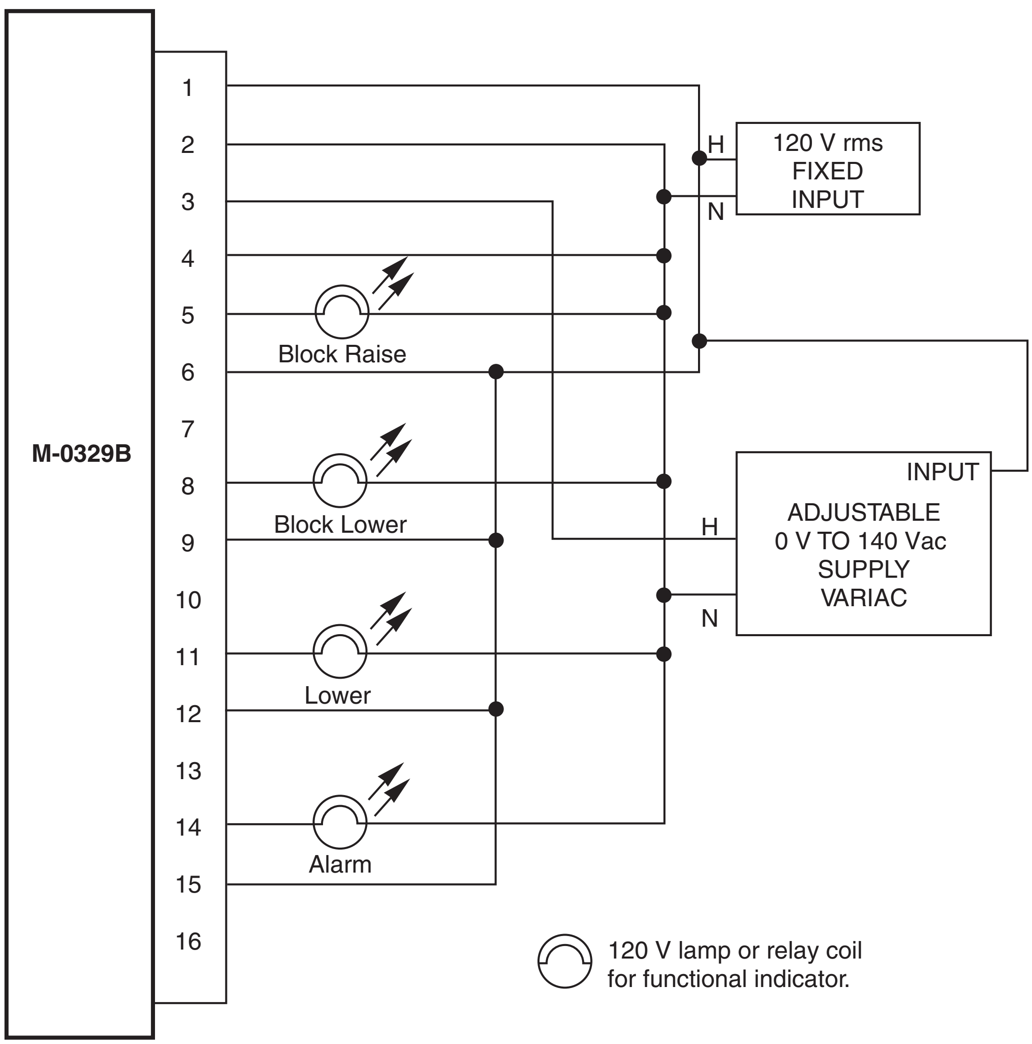


Figure 7 Test Setup Diagram

Procedure for Determining Voltage Bandcenter

When checking the voltage **BANDCENTER** settings, the exact voltage where the **BLOCK RAISE/LOWER** and **LOWER** LEDs light should be recorded. The voltage level Bandcenter is calculated as the average of these voltages:

$$Bandcenter\ Voltage = \frac{V_{Block\ Lower} + V_{Block\ Raise}}{2}$$

The voltage at which the **BLOCK RAISE/LOWER** and **LOWER** LEDs, and the functional indicators shown in Figure 7 turn on should be recorded in all cases. The band-edge hysteresis causes the LEDs to turn on and off at slightly different voltages.

Test Procedure

Refer to Figure 1 for a diagram depicting Bandcenter, Bandwidth and Fixed Deadband voltage levels.

Bandcenter Test

7. Set the **BANDWIDTH** dial at 6 V.
8. Set the **BANDCENTER** dial at 120 V and check the actual Bandcenter by varying the Voltage Input at TB1-3 to TB1-4. Be sure to position the **BANDCENTER** dial pointer exactly in the center of the line on the dial grid.
9. Repeat Step 2 at 108 V rms and 132 V rms.
10. The calculated values should be within ±1 V rms of the dial setting.

Bandwidth Test

11. The **BANDWIDTH** dial was previously set at 6 V Bandwidth. Check the actual Bandwidth by calculating the difference between $V_{Block\ Lower}$ and $V_{Block\ Raise}$.
12. Repeat Step 1 at 12 V Bandwidth, 18 V Bandwidth, and 24 V Bandwidth.
13. The Bandwidth should be within ±10% of setting.

Deadband (Block Raise to Lower) Test

14. Return the **BANDWIDTH** dial to 6 V.
15. Check the actual Bandwidth between the $V_{Block\ Raise}$ and V_{Lower} by recording the voltage at which the **LOWER** LED turns off.
16. Reduce the input voltage until the Block Raise functional indicator turns on.
17. Calculate the Deadband = $V_{Lower} – V_{Block\ Raise}$. The setting is selectable by the customer.
18. The calculated Deadband should be within ±3% of the setting.

Lower Timer Delay Test

19. Set the **TIME DELAY** potentiometer to 1 second (minimum).
20. Increase the input voltage until the **LOWER** LED lights. Using a stopwatch, measure the time required for the **LOWER** relay to pick up.
21. Adjust the **TIME DELAY** potentiometer to 30 seconds (maximum) and repeat Step 2.
22. The measured times should be within ±15% of setting.

Fixed Alarm Time Delay Test

23. Set the **BANDCENTER** control to 120 V rms.
24. Set the **BANDWIDTH** control to 6 V.
25. Decrease the input voltage until the **BLOCK RAISE/LOWER** LED lights. Using a stopwatch, measure the time required for the **ALARM** relay to de-energize.
26. The measured time should be 180 seconds ±20%.
27. Return the input voltage to 120 V rms or until the **BLOCK RAISE/LOWER** LED turns off.
28. Increase the voltage potential until the **BLOCK RAISE/LOWER** LED lights. Measure the time required for the **ALARM** relay to de-energize.
29. Remove the 120 Vac power source from the M-0329B. The **ALARM** relay should de-energize without a time delay.

Replaceable Fuses

There are two replaceable fuses: Fuse F1 (1A) BECO Part Number 420-00719, and Fuse F2 (1/2A) BECO Part Number 420-00725. See Figure 8 for Fuse location.

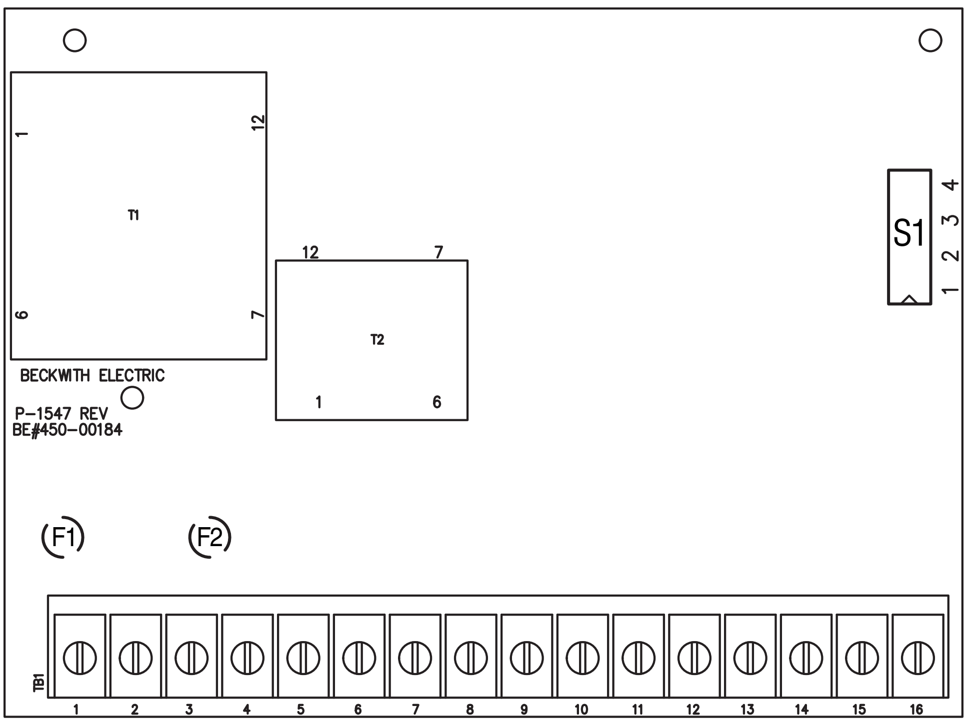


Figure 8 Simplified Component Location (Switch S1, Fuses F1 and F2)

Disposal and Recycling

Disposal of E-Waste for Beckwith Electric Products

The customer shall be responsible for and bear the cost of ensuring all governmental regulations within their jurisdiction are followed when disposing or recycling electronic equipment removed from a fixed installation.

Equipment may also be shipped back to Beckwith Electric for recycling or disposal. The customer is responsible for the shipping cost, and Beckwith Electric shall cover the recycling cost. Contact Beckwith Electric for an RMA # to return equipment for recycling.

TRADEMARKS

BECKWITH ELECTRIC
6190 118th Avenue North • Largo, Florida 33773-3724 U.S.A.
PHONE (727) 544-2326
beckwithelectricsupport@hubbell.com
www.beckwithelectric.com
ISO 9001:2015

M-0329B-SP-05 10/23