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## TAPCHANGER Controls

# AC Current Relay M-0127A/M-0170A



- M-0127A:
  0.01 to 0.1 Amps
- M-0170A: 0.2 to 0.4 Amps

- M-0127A intended for use in 0.2 A circulating current circuit of paralleled LTC transformers to guard against damaging excessive circulating current
- M-0170A prevents damage to LTC transformer's switching mechanism under excessive loads



#### **M-0127A Application**

The M-0127AAC Current Relay is primarily designed as a recommended addition to the Circulating Current or Delta VAr1 Paralleling configurations used with LTC Transformers. Its purpose is to monitor the current in the circulating loop between transformers, and interrupt Motor Power to its monitored transformer, should the circulating current exceed a predetermined value. The M-0127A range permits the maximum circulating current to be set from 5% to 50% of the rated full load current.

Other relays used for this purpose have an impedance exceeding  $5,000 \Omega$  which may cause the main CT to saturate, making the entire circulating current scheme operate poorly. The low impedance of the M-0127A relay avoids this problem.

The output should be connected in series with the common lead of the automatic control circuit of the motor starter relay. When used with the Beckwith Electric M-0067E control, the M-0127A output contacts will be in series with the lead that would otherwise have gone directly to terminal TB1-8 of the M-0067E. Polarity of the M-0127A input and output can be ignored.

#### **M-0170A** Application

The M-0170A AC Current Relay is intended to be used in the load current circuit to prevent the tapchanger from changing taps on excessive load current. Its range permits the current setting from 100% to 200% of the rated full load current. The relay is connected in the same manner as the M-0127A.

#### **Additional Applications**

The M-0127A and M-0170A can be used wherever an adjustable, low burden AC relay is required. They have virtually no time delay, a very small hysteresis and a normally closed output for use on AC only. The relay output draws approximately 6 mA of in-phase current through a 120 Vac load when open. These factors must be considered for the user's specific application.

By adding external series resistors, the relays may be used for voltage sensing. For example, with a 10 K series resistor, the M-0127A is adjustable from 100 to 140 Vac, using 10 to 14 mA current setting range. Use of a 10 K, 10 W wire-wound resistor is suggested.

### Output

▲ CAUTION: A capacitor must not be tied across the output or across output load as this will damage the triac in spite of fuse F1. The output is capable of handling a NEMA size 1 or smaller reversing-type motor starter.

The output is normally closed (with input current below threshold). The current carrying capability is shown in <u>Table 1</u>.

The output will draw approximately 6 mA of in-phase current through a 120 Vac load when the current exceeds the threshold. This will not be sufficient to hold in a NEMA-type starter. When used with old motor starters, a test should be made to make certain this small amount of current will not hold the relay closed. If it does, the air gap on the relay should be increased or other adjustments made so it will properly drop out.

**NOTE:** This current can be exceeded in controllers where the triacs do not conduct continuously, as long as the product of current times the duty cycle does not exceed the values in <u>Table 1</u>.

| Air Temperature<br>Around Relay | Maximum Continuous<br>AC Current |  |  |
|---------------------------------|----------------------------------|--|--|
| 25° C                           | 1.6 A                            |  |  |
| 40° C                           | 1.2 A                            |  |  |
| 60° C                           | 0.8 A                            |  |  |
| 80° C                           | 0.4 A                            |  |  |



For very short times, the surge current limit is shown in Table 2.

| Time Duration:<br>Cycles, 60 Hz | Non-Repetitive Surge:<br>Amps |  |  |  |
|---------------------------------|-------------------------------|--|--|--|
| 1                               | 25                            |  |  |  |
| 4                               | 16                            |  |  |  |
| 10                              | 11                            |  |  |  |
| 100                             | 6                             |  |  |  |

| Table 2 | Output   | Surge  | Current   | Limit  |
|---------|----------|--------|-----------|--------|
| 100000  | 00000000 | 000,20 | 000000000 | DUITUU |

#### Inputs

- All solid-state design, transient protected.
- Two terminal input, transformer isolated from the output.
- · Current setting adjusted with a calibrated dial.

**M-0127A:** 10 mA to 100 mA ac current range. 50/60 Hz, will withstand 2.5 A for one second. **M-0170A:** 200 mA to 400 mA ac current range. Withstand 10 A for one second.

#### **INPUT BURDEN:**

**M-0127A:**  $100 \Omega$  to  $500 \Omega$  dependent upon setting. **M-0170A:**  $2 \Omega$ .

#### **Outputs**

Two terminal ac switch (triac), normally conducting. Opens on input current above threshold setting. Rated 1 A at 120 Vac. Transient and overload protected. Load must not be highly capacitive. Auxiliary relay can provide parallel alarm function. Open circuit impedance: 20 K.

#### **Alarm Relay**

An alarm relay can be used in series with the output to obtain an alarm contact when the AC Current Relay has locked out the control. The following relay and socket are recommended:

- Relay: Potter & Brumfield KRP11AG: 120 Vac, DPDT contacts rated 10 A, 8-pin plug
- · Socket: Potter & Brumfield 27E122: 8-pin industrial type with screw terminals for surface mounting

**■NOTE:** Both are available from Beckwith Electric Company, Inc.

#### **Temperature Range**

Unit will operate properly from -40° C to +85° C.

#### **Terminal Block Connections/Torque Requirements**

The M-0127A and M-0170A AC Current Relays are listed to UL Standards for Safety by Underwriters Laboratories Inc. (UL). The wire should be No. 22–16 AWG inserted in an AMP #36157 (or equivalent) connector, and the screws tightened to 4.8 inch-pounds torque.

#### **Physical**

Size: 7-1/4" high x 6-6/16 wide x 4-3/8 deep (18.42 cm x 16.19 cm x 11.13 cm). Approximate Weight: 1.4 lbs. (0.6 kg). Approximate Shipping Weight: 3 lbs. (1.4 kg).

#### **Patent & Warranty**

The M-0127A/M-0170A is covered by U.S. Patent 3,883,782. The M-0127A/M-0170A is covered by a five year warranty from date of shipment.



Figure 1 AC Current Relay Circuit



Figure 2 M-0127A & M-0170A Mounting Cutout Dimensions



Figure 3 M-0127A & M-0170A Outline Dimensions

#### **Test Procedure**

#### **Equipment Required**

- AC current supply capable of supplying 500 mA.
- Digital voltmeter, Fluke model 8000A DMM or equivalent.
- Light bulb.
- 120 Vac source.
- AC milliammeter.

#### Test Setup

Make the connections to the AC Current Relay as shown in Figure 4.



Figure 4 Test Setup

#### Test Procedure

First check the typical readings from <u>Table 3</u> (M-0127A) or <u>Table 4</u> (M-0170A). The readings were taken referenced to ground with the unit calibrated to 20% accuracy. If the readings do not match, calibrate the unit according to the procedures in the **CALIBRATION** section.

#### **Typical Voltages**

Use right (–) side of C2 for ground as shown in <u>Figure 5</u>, Component Location.

| M-0127A<br>Front Panel<br>Setting | Input           | V <sub>REC</sub> | v <sub>c</sub> | Vs   | V <sub>R</sub> | vo   | V <sub>G</sub> | I <sub>1</sub> |
|-----------------------------------|-----------------|------------------|----------------|------|----------------|------|----------------|----------------|
| 10                                | 5               | 6.6              | 0.98           | 0.97 | 1.79           | 0.65 | 0.3            | Off            |
| 10                                | 15              | 9.82             | 3.89           | 3.85 | 2.62           | 5.88 | 0.67           | On             |
| 20                                | 15              | 7.66             | 1.85           | 1.83 | 2.13           | 0.67 | 0.3            | Off            |
| 20                                | 25              | 9.55             | 3.58           | 3.55 | 2.50           | 5.59 | 0.66           | On             |
| 100                               | 90              | 8.60             | 2.48           | 2.46 | 2.29           | 0.67 | 0.3            | Off            |
| 100                               | 110             | 9.23             | 2.07           | 2.04 | 2.48           | 5.53 | 0.66           | On             |
| in mA                             | in Volts dc 5%* |                  |                |      |                |      |                |                |

Table 3 M-0127A Typical Voltages

#### M-0127A/M-0170A AC Current Relay – Specification

| M-0170A | Input | V <sub>REC</sub> | v <sub>c</sub> | vs   | V <sub>R</sub> | vo  | V <sub>G</sub> | I <sub>1</sub> |
|---------|-------|------------------|----------------|------|----------------|-----|----------------|----------------|
| 200     | 100   | 7.9              | 1.8            | 1.8  | 2.11           | .64 | .3             | Off            |
| 200     | 250   | 9.4              | 3.22           | 3.20 | 2.5            | 5.7 | .7             | On             |
| 300     | 250   | 8.3              | 2.2            | 2.19 | 2.3            | .64 | .3             | Off            |
| 300     | 350   | 9.4              | 3.16           | 3.10 | 2.5            | 5.7 | .7             | On             |
| 400     | 350   | 8.5              | 2.26           | 2.23 | 2.3            | .64 | .3             | Off            |
| 400     | 410   | 8.9              | 2.7            | 2.67 | 2.4            | 5.4 | .7             | On             |

Table 4 M-0170A Typical Voltages

#### Calibration

Refer to Figure 5 Simplified Component Location.

- **NOTE:** Always calibrate the unit at the point where the relay trips during an increasing current. When the relay trips, the RELAY TRIPPED lamp on the front panel will light.
  - 1. Turn the front panel TRIP CURRENT control to maximum setting (fully clockwise).
  - 2. Adjust R4 for relay trip equivalent to this setting.
  - 3. Position the TRIP CURRENT control to the minimum setting (fully counterclockwise).
  - 4. Adjust R3 for relay trip equivalent to this setting.
  - 5. Repeat these procedures until both minimum and maximum settings are calibrated.



Figure 5 Simplified Component Location

#### TRADEMARKS

All brand or product names referenced in this document may be trademarks or registered trademarks of their respective holders.

Specification subject to change without notice. Beckwith Electric has approved only the English version of this document.

# **BECKWITH ELECTRIC**

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