General Description
A voltage sensitive, electromagnetic type motor starting relay with normally closed snap-action contacts used to disconnect the start capacitor on capacitor-start, induction-run and capacitor-start, capacitor-run motors. The relay has a protective cover which eliminates the need for additional electrical and mechanical protection. A variety of mounting brackets are available. Terminals may be either Quick Connect Tab Type or Screw Type.

Typical Applications
- Central air conditioner compressors
- Submersible pump motors
- Motors generally over 1/3 HP with start capacitors

Operation
The relay is energized by a magnet coil electrically connected across the start winding of the motor and responds to the increase in start winding voltage as the motor accelerates from zero to the normal running speed. The relay contacts are actuated by the armature of the relay to disconnect the start capacitor at a speed where the motor has sufficient torque to bring it up to normal running speed. The relay remains energized during the run operation of the motor, keeping the relay contacts open. When the motor is de-energized, the relay contacts re-close for the next motor start. Each relay is designed for a specific application which includes the coil rating for continuous run voltage and the pickup and dropout calibration for proper motor starting.

Terminals
- Quick Connect Type
  0.250” x 0.032” (6.3 mm x 0.8 mm)
- Screw Type, Tin Plated Brass
  #8-32 Thread

Electrical Ratings
- Contacts
  35 Amperes max, 50/60 Hz, break only (3ARR3)
  50 Amperes max, 50/60 Hz, break only (3ARR22)
- Continuous Coil Rating
  60 Hz; 130 to 500 Volts
  50 Hz; 117 to 470 Volts

See Appendix “B” for Coil Groups and Ratings.

Potential Motor Start Relay
35A and 50A Rating

Endurance
- 100,000 to 500,000 operations (depending on load)

Mounting
- Mounting Bracket
  Select from available brackets in Appendix “C”.
- Mounting Position
  Each relay is calibrated in the intended mounting position. Specify desired mounting position from Appendix “D”.

Circuits
If there is a terminal in position #6, it must be the same polarity as terminals #1, #2, and #4 to prevent possible flashover. If there is no terminal in #6 position, #4 can be either polarity.

ZETTLER Controls, Inc.
www.zettlercontrols.com
75 COLUMBIA • ALISO VIEJO, CA 92656 • PHONE: (949) 360-5840 • FAX: (949) 360-5839 • E-MAIL: SALES@ZETTLERCONTROLS.COM
Application Procedure
Use the part number scheme from Appendix “A” to create part number requirements.

Calibration
Relay is factory calibrated for pickup and dropout voltages to match motor speed and torque curves for the specific application requirements. See Appendix “B” for calibrations available for each coil group.

Agency Approvals
UL File #SA 44129
CSA included in UL
APPENDIX A (Ordering Part Number)

Relay model number (Example: 3ARR3AA2A1)

3ARR

Mounting Position (#1 to #6) Appendix D

Coil Calibration (One or two letters) Appendix B

Coil Group (One or two digits) Appendix B

Mechanical Form (One or two letters)* Appendix C

Basic Model Type (3 or 22)**

* Mechanical Form per appendix C or assigned by the ZC Application Engineer as required.

** Basic Model Type is selected based on capacitor disconnect current ("3" for 35A) ("22" for 50A).
APPENDIX B  (Coil Group and Calibration)

THE CONTINUOUS DUTY VOLTAGE OF THE RELAY COIL MUST BE EQUAL TO OR GREATER THAN THE MAXIMUM VOLTAGE TO WHICH IT WILL BE EXPOSED. THIS VOLTAGE WILL BE THE VOLTAGE INDUCED IN THE MOTOR START WINDING WHEN THE MOTOR IS RUNNING AFTER THE START WINDING HAS BEEN DISCONNECTED. IT WILL BE THE GREATEST WHEN THE LINE VOLTAGE IS AT ITS MAXIMUM. WHEN THE MOTOR IS RUNNING AT ITS MAXIMUM SPEED LIGHTLY LOADED, AND WHEN THE RUN CAPACITOR SIZE IS LARGEST.

THE EFFECT OF THE "EFFECTIVE AMBIENT TEMPERATURE" SURROUNDING THE RELAY MUST ALSO BE TAKEN INTO ACCOUNT.

THE EFFECTIVE AMBIENT TEMPERATURE IS NOT THE AMBIENT TEMPERATURE IN WHICH THE APPLIANCE OR EQUIPMENT IS INSTALLED, BUT IS THE AMBIENT TEMPERATURE SURROUNDING THE RELAY WHILE THE APPLIANCE IS OPERATING. OFTEN THE ENCLOSED CONTROL COMPARTMENT WILL BE SUBSTANTIALLY HIGHER IN TEMPERATURE THAN THE AREA AROUND THE APPLIANCE. IN SOME CASES OTHER HEAT SOURCES OR RADIANT EFFECTS ARE CONTRIBUTORS TO ITS TEMPERATURE.

THE MAXIMUM ALLOWABLE TEMPERATURE OF THE COIL WINDING IS 120°C, WHEN MEASURED BY CHANGE IN RESISTANCE METHOD.

THIS MEANS THAT THE COIL GROUP NUMBER SELECTED MUST NOT PRODUCE A HEAT RISE, WHICH WHEN ADDED TO THE EFFECTIVE AMBIENT TEMPERATURE, WILL RESULT IN THE COIL TEMPERATURE EXCEEDING THE MAXIMUM ALLOWABLE FOR THE SPECIFIC INSULATION CLASS.

IF THIS SHOULD OCCUR, A COIL GROUP SHOULD BE SELECTED WHICH WILL PRODUCE A LOWER HEAT RISE WITH THE MAXIMUM VOLTAGE APPLIED TO THE COIL. A GROUP WITH A HIGHER COIL RATING WILL PRODUCE A LOWER HEAT RISE AT A SPECIFIC APPLIED VOLTAGE.

IF THE COMPRESSOR/MOTOR MANUFACTURER IS NOT SURE OF THE ACTUAL EFFECTIVE AMBIENT TEMPERATURE IN WHICH THE RELAY IS INSTALLED, A WORST CONDITION OF 40°C OR HIGHER SHOULD BE USED IN SELECTING THE PROPER COIL GROUP, FOR EXAMPLE, UNITS INSTALLED OUTDOORS OR IN TIGHTLY CONFINED SPACES.

TO PREDICT A HEAT RISE AT A NEW VOLTAGE, MULTIPLY THE KNOWN RISE AT A SPECIFIC VOLTAGE BY THE SQUARE OF THE RATIO OF THE NEW VOLTAGE OVER THE OLD.

TABLES OF COILS BY GROUP, ALONG WITH CALIBRATION IDENTIFICATION FOLLOW ON SHEETS 1 THRU 4. THE COIL RATINGS FOR SPECIFIC GROUPS FOR 50 HZ OPERATION ARE ON SEPARATE SHEETS. IT SHOULD BE NOTED THAT FOR A GIVEN COIL GROUP, THE VOLTAGE RATING AT 60 HZ IS HIGHER THAN FOR 50 HZ.

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### ZC MOTOR START RELAY (3ARR3, 3ARR22) DATA

**CUSTOMER COLD PICK-UP AND DROP-OUT FOR EACH COIL GROUP**

**CALIBRATION VALUES ARE BASED ON AVERAGE COIL COPPER TEMPERATURES OF: COLD 35°C HOT 90°C.**

**COIL GROUPS ARE U.L. CLASS B RATINGS AND VDE RECOGNIZED.**

(U.L. FILE SA 44129)

<table>
<thead>
<tr>
<th>GROUP 2, 12</th>
<th>GROUP 3, 13</th>
<th>GROUP 4, 14</th>
<th>GROUP 5, 15</th>
<th>GROUP 6, 16</th>
<th>GROUP 7, 17</th>
<th>GROUP 8, 18</th>
<th>GROUP 9, 19</th>
<th>GROUP 10, 20</th>
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<tbody>
<tr>
<td>HOT PICK-UP VOLTS</td>
<td>MIN</td>
<td>MAX</td>
<td>MIN</td>
<td>MAX</td>
<td>MIN</td>
<td>MAX</td>
<td>MIN</td>
<td>MAX</td>
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<td>300</td>
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<td>60</td>
<td>300</td>
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<td>260</td>
<td>290</td>
<td>55</td>
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<td>60</td>
<td>320</td>
<td>340</td>
<td>269</td>
<td>297</td>
<td>50</td>
<td>100</td>
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<td>E</td>
<td>60</td>
<td>340</td>
<td>360</td>
<td>317</td>
<td>345</td>
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<td>326</td>
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<td>G</td>
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<td>H</td>
<td>60</td>
<td>365</td>
<td>395</td>
<td>346</td>
<td>376</td>
<td>70</td>
<td>150</td>
<td>346</td>
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**MOUNTING POSITIONS**

<table>
<thead>
<tr>
<th>POS. 1</th>
<th>POS. 2</th>
<th>POS. 3</th>
<th>POS. 4</th>
<th>POS. 5</th>
<th>POS. 6</th>
</tr>
</thead>
</table>

**COIL RESISTANCE @ 25°C (OHMS) REFERENCE**

| 1,620 | 6,050 | 14,620 | 4,000 | 11,500 | 830 | 2,600 | 5,950 | 9,400 |

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### ZC Motor Start Relay (3ARR3, 3ARR22) Data

**Customer Cold Pick-Up and Drop-Out for Each Coil Group**

**Calibration Values are Based on**
- Average Coil Copper Temperatures of: Cold 35°C Hot 95°C

**Coil Groups Are U.L. Class B Ratings and VDE Recognized.**

<table>
<thead>
<tr>
<th>Frequency (Hertz)</th>
<th>Group 2, 12</th>
<th>Group 3, 13</th>
<th>Group 4, 14</th>
<th>Group 5, 15</th>
<th>Group 6, 16</th>
<th>Group 7, 17</th>
<th>Group 8, 18</th>
<th>Group 9, 19</th>
<th>Group 10, 20</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hot Pick-Up Volts</td>
<td>Min</td>
<td>Max</td>
<td>Min</td>
<td>Max</td>
<td>Min</td>
<td>Max</td>
<td>Min</td>
<td>Max</td>
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<tr>
<td>50</td>
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<td>1,250</td>
<td>250</td>
<td>1,250</td>
<td>250</td>
</tr>
</tbody>
</table>

**Coil Resistance @ 25°C (Ohms Reference)**
- 1.620
- 6.050
- 14.820
- 4.080
- 11.609
- 630
- 2,560
- 5,550
- 9,400

**Mounting Positions**
- POS. 1
- POS. 2
- POS. 3
- POS. 4
- POS. 5
- POS. 6

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### ZC MOTOR START RELAY (3ARR3, 3ARR22) DATA

**CUSTOMER COLD PICK-UP AND DROP-OUT FOR EACH COIL GROUP**

COIL GROUPS ARE U.L. CLASS B RATINGs AND VDE RECOGNIZED.

<table>
<thead>
<tr>
<th>GROUP ID</th>
<th>MAXIMUM COIL VOLTAGES FOR SPECIFIED MAXIMUM TEMPERATURE RISE</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th></th>
<th></th>
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<tbody>
<tr>
<td>148VΔ80°C</td>
<td>194VΔ80°C</td>
<td>256VΔ60°C</td>
<td>336VΔ60°C</td>
<td>450VΔ80°C</td>
<td>564VΔ80°C</td>
<td>530VΔ80°C</td>
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<td></td>
</tr>
<tr>
<td>130VΔ60°C</td>
<td>170VΔ60°C</td>
<td>256VΔ60°C</td>
<td>336VΔ60°C</td>
<td>450VΔ80°C</td>
<td>564VΔ80°C</td>
<td>530VΔ80°C</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**CALIBRATION VALUES ARE BASED ON AVERAGE COIL COPPER TEMPERATURES OF: COLD 35°C HOT 95°C.**

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ZC MOTOR START RELAY (3ARR3, 3ARR22) DATA

CALIBRATION VALUES ARE BASED ON AVERAGE COIL COPPER TEMPERATURES
OF: COLO 35°C
HOT 50°C.

MAXIMUM COIL VOLTAGES FOR SPECIFIED MAXIMUM TEMPERATURE RISE

<table>
<thead>
<tr>
<th>CALIBRATION IDENTIFICATION</th>
<th>FREQUENCY (HERTZ)</th>
<th>MHT</th>
<th>PICK-UP VOLTS</th>
<th>DROP-OUT VOLTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>GROUP 21, 41</td>
<td>135V-Δ60°C</td>
<td>174V-Δ60°C</td>
<td>262V-Δ50°C</td>
<td>344V-Δ60°C</td>
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<tr>
<td>AK 50</td>
<td>130 140</td>
<td>100 110 45</td>
<td>119 134 55</td>
<td>220 234 55</td>
</tr>
<tr>
<td>AX 50</td>
<td>70 80</td>
<td>0 10 45</td>
<td>119 134 55</td>
<td>220 234 55</td>
</tr>
<tr>
<td>AZ 50</td>
<td>80 90</td>
<td>0 10 45</td>
<td>119 134 55</td>
<td>220 234 55</td>
</tr>
</tbody>
</table>

COIL RESISTANCE
@ 25°C (OHMS) REFERENCE
1.350 2.200 5.220 8.000 11.600 13.260 15.900 17.660

MOUNTING POSITIONS

UP

POS. 1
POS. 2
POS. 3
POS. 4
POS. 5
POS. 6

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**3ARR3, 3ARR22 Type**

**APPENDIX C**  
(Mechanical Form)

---

**METAL BRACKET MOUNT**
(Screw Termination)  
Bracket 741A584

- **A5** - (5 Terminals, Dual on #4)
- **A3** - (3 Terminals)

**METAL BRACKET MOUNT**  
(QD Terminals)  
Bracket 741A584

- **B5** - (5 Terminals, Dual on #4)
- **B3** - (3 Terminals)

**UNIVERSAL BRACKET MOUNT**  
(Screw Terminals) (QD Terminals)
Bracket 74-500536-5

- **C5** - (5 Terminals, Dual on #4)
- **C3** - (3 Terminals)
- **D5** - (5 Terminals, Dual on #4)
- **D3** - (3 Terminals)

**PLASTIC TAB MOUNT**  
(Screw Terminals) (QD Terminals)

- **E5** - (5 Terminals, Dual on #4)
- **E3** - (3 Terminals)
- **F5** - (5 Terminals, Dual on #4)
- **F3** - (3 Terminals)

**PANEL MOUNT**  
(Screw Terminals) (QD Terminals)

- **G5** - (5 Terminals, Dual on #4)
- **G3** - (3 Terminals)
- **H5** - (5 Terminals, Dual on #4)
- **H3** - (3 Terminals)

*Several bracket mounting options available*