

# AZEV140

## 40 AMP POWER RELAY WITH MONITORING

### FEATURES

- Designed for IEC 61851 Mode 2 charging applications
- NO load contact plus NC signal contact for welding monitoring
- 40 Amp nominal, up to 50 Amp switching capability
- Electrical ratings according IEC 61851-1: CC2 / 50.000 cycles
- Withstands up to 1850 A short circuit current
- Wide load contact gap of  $\geq 2.25$  mm
- Dielectric strength 4 kV<sub>RMS</sub>, surge withstand voltage 6 kV
- TÜV, UL / CUR and CQC approvals



### CONTACTS

|                                                                                                                                                |                                                                                                                                                                                                                                                                                                                       |
|------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Arrangement</b><br>load contact<br>signal contact                                                                                           | SPST-NO (1 Form A)<br>SPST-NC (1 Form B) coupled to NO load contact                                                                                                                                                                                                                                                   |
| <b>Ratings (max.)</b><br>load contact<br>switched power<br>switched current<br>continuous current<br>switched voltage<br>contact load category | (resistive load)<br><br>22000 VA<br>50 A<br>50 A<br>440 VAC<br>CC2                                                                                                                                                                                                                                                    |
| signal contact<br>switched current<br>minimum load                                                                                             | 10 mA at 12 VDC<br>10 mA, 5 VDC, 50mW (gold plated contact)                                                                                                                                                                                                                                                           |
| <b>Approved ratings</b><br>load contact                                                                                                        | <b>UL/CUR/TÜV/CQC</b><br>40 A at 440 VAC, resistive, 85°C, 30k cycles<br>32 A at 440 VAC, resistive, 85°C, 50k cycles<br>50 A at 440 VAC, resistive, 85°C, 6k cycles<br>20 A make, 50 A carry, 20 A break at 440 VAC, resistive, 85°C, 50k cycles<br><br><b>UL/CUR</b><br>24 A at 30 VDC, resistive, 85°C, 50k cycles |
| Signal contact                                                                                                                                 | 10 mA at 12 VDC, 85°C, 50k cycles                                                                                                                                                                                                                                                                                     |
| <b>Contact material</b><br>load contact<br>signal contact                                                                                      | AgSnO <sub>2</sub> (silver tin oxide)<br>AgNi + Au (silver nickel, gold plated)                                                                                                                                                                                                                                       |
| <b>Contact gap</b><br>load contact                                                                                                             | (clearance of open load contacts)<br>$\geq 2.25$ mm                                                                                                                                                                                                                                                                   |
| <b>Initial contact resistance</b>                                                                                                              | $\leq 50$ m $\Omega$ (at 6V, 1A, voltage drop method)<br>$\leq 3$ m $\Omega$ (at 40 A, contact factory for details, typical)                                                                                                                                                                                          |

### COIL

|                                               |                                                                                       |
|-----------------------------------------------|---------------------------------------------------------------------------------------|
| <b>Nominal coil voltages</b>                  | 5, 9, 12, 24, 48 (DC)                                                                 |
| <b>Dropout voltage</b>                        | > 5% of nominal coil voltage                                                          |
| <b>Holding voltage</b>                        | > 35% of nominal coil voltage (at 23°C)<br>55 - 65% of nominal coil voltage (at 85°C) |
| <b>Coil power</b><br>nominal<br>holding power | (at 23 °C)<br>2.1 W<br>260 mW                                                         |
| <b>Temperature rise</b>                       | 70 K (126°F) at nominal coil voltage, 85°C                                            |
| <b>Insulation system</b>                      | class F, max. temperature 155°C (311°F)                                               |

### GENERAL DATA

|                                                                                                                                                         |                                                                                                                                                                                |
|---------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Life Expectancy</b><br>mechanical<br>electrical                                                                                                      | (minimum operations)<br>1 x 10 <sup>5</sup><br>see approved ratings                                                                                                            |
| <b>Timing</b><br>operate time<br>release time                                                                                                           | (at nominal coil voltage)<br>$\leq 30$ ms<br>$\leq 10$ ms (without coil suppression)                                                                                           |
| <b>Dielectric Strength</b><br>open load contacts<br>coil to load contacts<br>open signal contacts<br>coil to signal contacts<br>signal to load contacts | (at sea level for 1 min.)<br>2500 V <sub>RMS</sub><br>4000 V <sub>RMS</sub><br>500 V <sub>RMS</sub><br>500 V <sub>RMS</sub><br>4000 V <sub>RMS</sub>                           |
| <b>Surge voltage</b><br>open load contacts<br>coil to load contacts<br>signal to load contacts                                                          | 6 kV<br>6 kV<br>6 kV                                                                                                                                                           |
| <b>Insulation Distances</b><br>open load contacts<br>coil to load contacts<br>coil to signal contacts<br>signal to load contacts                        | (clearance / creepage)<br>$\geq 2.25$ mm / $\geq 4.2$ mm<br>$\geq 4.4$ mm / $\geq 5.0$ mm<br>$\geq 2.0$ mm / $\geq 2.0$ mm<br>$\geq 4.0$ mm / $\geq 4.7$ mm                    |
| <b>Insulation Resistance</b>                                                                                                                            | 1000 M $\Omega$ (min.) at 23°C, 500 VDC, 50% RH                                                                                                                                |
| <b>Pulse current capability</b>                                                                                                                         | $\geq 1.50$ kA , $\geq 6.0$ kA <sup>2</sup> s<br>(based on requirements of IEC 62752)<br>$\geq 1.85$ kA , $\geq 4.5$ kA <sup>2</sup> s<br>(based on requirements of IEC 62955) |
| <b>Insulation type</b><br><br>Coil to load contacts                                                                                                     | Basic insulation (rated voltage > 250VAC)<br>Reinforce insulation (rated voltage $\leq 250$ VAC)                                                                               |
| <b>Temperature Range</b><br>operating                                                                                                                   | (at nominal coil voltage)<br>-40°C (-40°F) to 85°C (185°F)                                                                                                                     |
| <b>Vibration resistance</b>                                                                                                                             | 0.062" (1.5 mm) DA at 10–55 Hz                                                                                                                                                 |
| <b>Enclosure</b><br>protection category<br>material<br>material group<br>Flammability                                                                   | RT II, flux proof<br>PBT, polyester<br>Illa<br>UL94 V-0                                                                                                                        |
| <b>Terminals</b>                                                                                                                                        | Tinned copper alloy, THT PCB mounting                                                                                                                                          |
| <b>Soldering</b><br>preheating<br>soldering                                                                                                             | (referring IEC 61760-1 wave soldering)<br>120°C (248°F) / $\leq 120$ s<br>260 $\pm 5$ °C (500 $\pm 9$ °F) / $\leq 10$ s                                                        |
| <b>Dimensions and Weight</b>                                                                                                                            | 35 mm x 16 mm x 28 mm, 35 grams                                                                                                                                                |
| <b>Compliance</b>                                                                                                                                       | UL 508, IEC 61810-1, GB/T 21711.1-2008<br>RoHS, REACH<br>designed to meet requirements of IEC 62752                                                                            |
| <b>Agency Approvals</b><br>UL / CUR<br>TÜV<br>CQC                                                                                                       | E365652<br>B 088793 0016<br>CQC20002276475                                                                                                                                     |
| <b>Packing (pcs.)</b>                                                                                                                                   | 50 per plastic tray<br>400 per carton box                                                                                                                                      |

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## COIL VOLTAGE SPECIFICATIONS

| Voltage [VDC] |              |              |      | Resistance [Ω] ±10% | Current (ref.) [mA] | Power (ref.) [W] |              |
|---------------|--------------|--------------|------|---------------------|---------------------|------------------|--------------|
| nominal       | must operate | min. holding | max. |                     | min. holding        | nominal          | min. holding |
| 5             | 3.75         | 1.75         | 6.0  | 11.8                | 148                 | 2.1              | 0.26         |
| 9             | 6.75         | 3.15         | 10.8 | 38.4                | 82                  |                  |              |
| <b>12</b>     | 9.0          | 4.2          | 14.4 | 68.5                | 62                  |                  |              |
| <b>24</b>     | 18.0         | 8.4          | 28.8 | 274.0               | 31                  |                  |              |
| 48            | 36.0         | 16.8         | 57.6 | 1096.0              | 16                  |                  |              |

Notes:

1. All values at 23°C, upright position, terminals downward.
2. Voltage max. is the voltage the coil can endure for a short period of time.
3. Values for coil current and coil power for reference only.
4. To avoid overheating at elevated ambient temperatures, we recommend to operate the coil at 55 - 65% of nominal coil voltage after applying the full nominal coil voltage for ≥200 ms.
5. Preferred coil voltages in bold face numbers.

## ORDERING DATA

AZEV140-1AE- -D-

Options

nil: standard version  
(xxx): special version

Nominal coil voltage  
see coil voltage specifications table

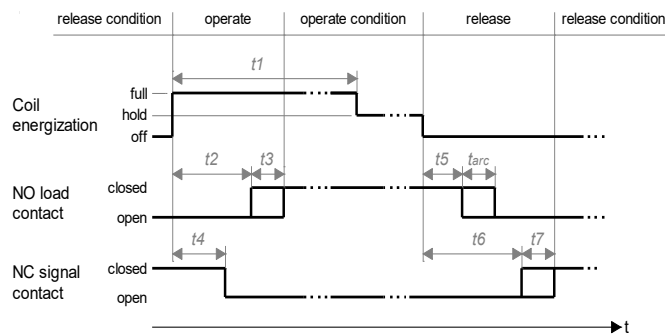
Signal contact

nil: without signal contact  
1BG: equipped with 1 Form B signal contact

## Example ordering data

AZEV140-1AE-24D Without signal contact, 24VDC coil  
AZEV140-1AE1BG-12D With 1 Form B signal contact, 12VDC coil

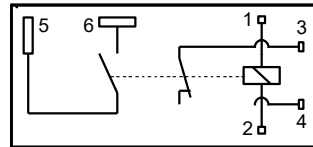
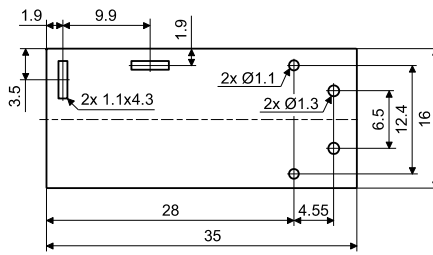
## TIMING DIAGRAM



| Item             | Description            | Notes                                                      | Timing [ms] |      |      |
|------------------|------------------------|------------------------------------------------------------|-------------|------|------|
|                  |                        |                                                            | min.        | typ. | max. |
| t1               | Full energization time | recommended value                                          | 200         | -    | -    |
| t2               | NO operate time        | at nominal coil voltage (at 23°C) <sup>1)</sup>            | -           | < 10 | 30   |
|                  |                        | at nominal coil voltage (at hot coil) <sup>2)</sup>        | -           | < 20 | 65   |
| t3               | NO bounce time         | at nominal coil voltage                                    | -           | < 2  | -    |
| t4               | NC operate time        | at nominal coil voltage (at 23°C) <sup>1)</sup>            | -           | < 7  | 20   |
|                  |                        | at nominal coil voltage (at hot coil) <sup>2)</sup>        | -           | < 12 | 40   |
| t5               | NO release time        | without coil suppression                                   | -           | < 2  | 10   |
|                  |                        | with suppression: $U_{BR}/U_{nom} = 2^{-3}$                | -           | < 3  | -    |
| t6               | NC release time        | with suppression: $U_{BR}/U_{nom} = 2^{-3}$                | -           | < 4  | 10   |
| t7               | NC bounce time         |                                                            | -           | < 8  | -    |
| t <sub>arc</sub> | arcing duration        | if released under load, dependent on actual load condition |             |      |      |

## PC BOARD LAYOUT / WIRING DIAGRAMS

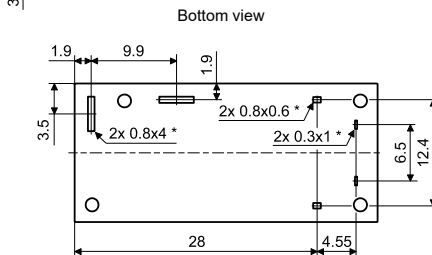
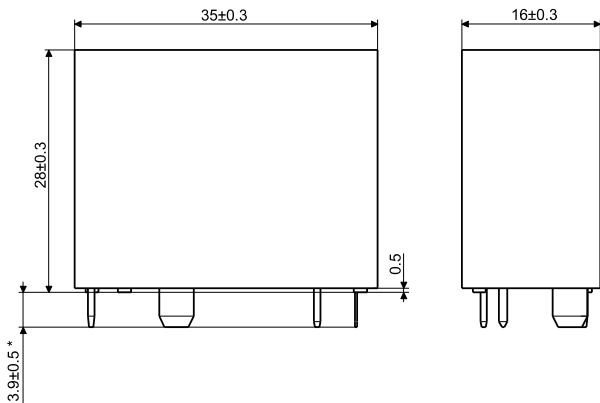
Layout and footprint recommendation. Dimensions in mm. Viewed towards terminals.  
Note: Pins 3 and 4 are omitted in versions without 1 Form B signal contact.



|      |                                   |
|------|-----------------------------------|
| 1    | Coil end - winding outer layer    |
| 2    | Coil start - winding center layer |
| 3, 4 | NC signal contact                 |
| 5    | NO load contact - movable         |
| 6    | NO load contact - stationary      |

## MECHANICAL DATA

Dimensions in mm. Tolerance ±0.1mm if not stated otherwise.  
Notes: \* Pin dimensions for reference only and given without tin coating.



CAD data in attachment of the datasheet.

## IEC 62752 / IEC 62955 Short Circuit Withstand

Compliance with IEC 62752, IEC 62955 or similar standards for short circuit withstand is a function of both relay design and PCB layout. ZETTLER's relay design and applications engineering teams have developed an application note that contains important design suggestions to optimize the performance of the relay with respect to its short circuit current withstand capability.

In addition, as the overall performance depends on multiple factors such as part arrangement and trace routing, compliance cannot be generically guaranteed by ZETTLER. We strongly encourage customers to conduct their own short circuit tests in accordance with IEC 62752, IEC 62955 or similar standards in the context of their individual application design.

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## NOTES

### General

1. All values in this datasheet are at reference temperature of 23°C (73°F) unless stated otherwise.
2. Evaluate the component's performance and operating conditions under the worst-case conditions of the actual application.
3. The datasheet and the component's specifications are subject to change without notice.

### Storage, handling, and environmental guidelines

4. Relays are electromechanical components that are sensitive to shock. The relay's adjustment can be affected if the relay is subjected to excessive shock or excessive pressure is applied to the relay case. Relays which have been dropped must no longer be used.
5. Substances containing silicone or phosphorus must be avoided in the vicinity to the relay. Outgassing from these substances can penetrate the relay and adhere on the contacts. Deposits of these substances may act as insulators and adversely affect the contact resistance. Silicone can be found e.g. in gaskets, lubricants or filling materials, phosphorus can be found e.g. as a flame retardant in plastics.
6. Protect relays from atmospheres containing corrosive gases, liquids, or solids such as water vapor, H<sub>2</sub>S, SO<sub>2</sub>, NO<sub>2</sub>, Cl, P, dust, and other harmful substances and elements. Corrosion of internal structures and contacts leads to malfunction and shortens the component's service life.
7. Prevent non-sealed relays and relays with opened vent hole from atmospheres subject to dust. Dust particles may enter the case and get stuck between the contacts, causing the contact circuits to fail. Do not use these relays in environments with explosive or flammable gases. Electrical arcing at the contacts could ignite these gases and cause fire.
8. For automated dual wave soldering process we recommend preheating with 120°C (248°F) for max. 120 seconds and a soldering temperature of 260 ±5°C (500 ±9°F) for max. 10 seconds soldering time (max. 5 seconds per wave). For manual soldering we recommend 350°C (662°F) max. temperature for max. 5 seconds. During the soldering process, no force may be exerted on the relay terminals.
9. Non-sealed relays must not be washed, immersion cleaned or conformal coated as substances may enter the case and cause corrosion or seizure of mechanical parts.
10. Avoid high frequency or ultrasonic vibrations on the relays as these can cause contact welding and misalignment or destruction of internal structures.
11. During operation, storage and transport, ambient temperature should be within the specified operating temperature range. Humidity should be in the range of 5% to 85% RH. Icing and condensation must be avoided. Relays stored for an extended period of time may show initially increased contact resistance values due to chemical effects such as oxidation.
12. With sealed versions of this relay type, the vent hole must be cut open after washing or conformal coating to achieve the specified performance and service life. Care must be taken to ensure no particles get into the relay as a result of the cutting process.

### Design guidelines

13. The relay may pull in and operate with less than the specified *must operate* voltage value.
14. The coil's *must operate* and *min. holding* voltages, the coil's *ohmic resistance* and the relay's *operate time* depend on the temperature of the coil. The specified values are given for a coil temperature of 23°C and increase by approx. 0.39% per Kelvin of temperature rise. This circumstance must be considered, especially during operation with high load currents and elevated ambient temperature.
15. Coil suppression circuits such as diodes, etc. in parallel to the coil will lengthen the release time. We recommend using suppression circuits with a breakdown voltage of approx. 2 times the nominal coil voltage in order to achieve a quick release time.
16. For short-circuit performance according IEC62955, IEC61008-1 or IEC62752 (if datasheet has this parameter), coil suppression circuits with a breakdown voltage of ≥ 2 times the nominal coil voltage must be used. Using rectifier diodes or similar in parallel to the coil is not appropriate.
17. When using PWM coil control, use a fast-switching recirculation diode in parallel with the coil to keep the coil current during pulse pauses. To achieve the IEC62955, IEC61008-1 or IEC 62752 (if datasheet has this parameter) required short-circuit performance, when de-energizing the coil, the recirculation diode must be eliminated from the circuit to get a fast decay of coil current and a short release time. As PWM frequency we recommend ≥ 15 kHz in order to avoid audible noise from magnetostriction. To reduce EMI effects, we recommend to apply the PWM to the coil's inner layer terminal and have the outer layer terminal connected to ground or the supply rail.
18. Contact resistance is a function of load current, dwell time and wear level of the contacts. Immediately after closing the contacts, or if tested with low current only, the contact resistance will show a relatively high value. A low level steady state contact resistance is reached at higher current after a certain time in thermal equilibrium.
19. The relay dissipates heat form power losses through its load terminals. Provide sufficient cross section and area of the PCB traces so that they can act as heat spreader.
20. For PCBs with multiple relays, do not place the components directly next to each other. We suggest providing a mounting distance of minimum 10 mm to allow for better cooling.
21. A minimum load of 10 mA / 5 V / 50 mW is recommended for the gold plated monitor contact (if it has) to ensure a reliable and stable electrical connection.
22. As with any contact mechanism, the relay's NC monitor contact (if it has) bounces when switching. For evaluation of its signal, suitable debouncing measures must be taken to get a reliable signal.
23. At elevated ambient temperatures, after applying the rated nominal coil voltage for ≥ 10 times of operate time, the coil energization must be reduced to a holding level in order to reduce thermal stress and prevent the coil from overheating.

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## DISCLAIMER

This product specification is to be used in conjunction with the application notes which can be downloaded from the regional ZETTLER relay websites. The specification provides an overview of the most significant part features. Any individual applications and operating conditions are not taken into consideration. It is recommended to test the product under application conditions. Responsibility for the application remains with the customer. Proper operation and service life cannot be guaranteed if the part is operated outside the specified limits.

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