AZEV400

4 × 50 AMP / 2 × 80 AMP POWER RELAY WITH MONITORING

FEATURES

- Designed for IEC 61851 Mode 3 and SAE J1772 AC Level 2 charging applications
- 2 or 4 NO load contacts plus NC mirror contact acc. IEC 60947-4-1 / IEC 61810-3
- Wide NO load contact gap of ≥ 4.0mm, optional pre-make NO load contact
- 4 pole 50 A / 480 VAC or 2 pole 80 A / 480 VAC switching capacity
- Electrical ratings according IEC 61851-1: CC2 / 50,000 cycles
- Withstands inrush currents according IEC 62752 cl. 9.8 and ISO 17409 cl. 8.2.2
- Meets IEC 62955, IEC 62752, IEC 61008-1, IEC 62052-11 short circuit requirements
- Dielectric strength 5 kV_{RMS}, surge withstand voltage 10 kV
- TÜV, UL/CUR and CQC approvals

CONTACTS

Arrangement	
load contacts	4PST-NO (4 Form A) / 2PST-NO (2 Form A)
monitor contact	SPST-NC (1 Form B) coupled to load contacts
Ratings (max.)	(resistive load)
load contacts	
switched power	41.5 kVA (LLLN), 24 kVA (single contact)
switched current	50 A (single contact) / 80 A (parallel contacts) [2]
continuous current	50 A (single contact) / 80 A (parallel contacts) [2]
switched voltage	480 VAC
contact load category	CC2
monitor contact	
switched current	500 mA, 12 VDC
recommended min. load	10 mA, 5 VDC, 50 mW (gold plated contact)
Rated Loads	(TÜV, UL/CUR, CQC) [1]
load contact	50 A at 480 VAC, resistive, 85°C, 50k cycles 32 A at 480 VAC, resistive, 95°C, 50k cycles 16 A at 480 VAC, resistive, 85°C, 100k cycles 80 A at 480 VAC, resistive, 85°C, 10k cycles [2] 32 A at 480 VAC, AC1, 50k cycles, IEC 60947-4-1 [3] 230A inrush current, IEC 62752 cl. 9.8 [4]
monitor contact	500 mA at 12VDC, 95°C, 100k cycles [5]
Contact material	
load contact	$AgSnO_2$ (silver tin oxide)
monitor contact	AgNi (silver nickel, gold plated)
Contact gap	
load contact	≥ 4.0 mm
monitor contact	≥ 0.7 mm (≥ 0.5 mm if load contacts welded)
Contact resistance	
initial	load contact: ≤ 10 mΩ (6 VDC, 20 A) monitor contact: ≤ 100 mΩ (6 VDC, 1 A)
typ.	load contact: ≤ 1.5 mΩ (32 A)

Notes:
1) All approvals with open vent hole only.
2) Valid only for 4-pole (4PST-NO) type with load contact sets connected in parallel, see chapter *Wiring Diagram*.
3) IEC 60947-4-1 AC1 approval at TÜV.
4) IEC 62752 cl. 9.8 / ISO 17409 cl. 8.2.2 tested at TÜV.
5) Monitor contact according IEC 60947-4-1 annex F.7.2. and IEC 61810-3 cl. 5.3

COIL

Nominal coil DC voltages	6, 9, 12, 24
Dropout voltage	> 5% of nominal coil voltage
Holding voltage	35% - 80% of nominal coil voltage (at 23°C) 40% - 65% of nominal coil voltage (at 85°C)
Coil power	nominal / holding (at 23 °C)
4-pole type (4PST-NO)	4.8 W / 0.8 W
2-pole type (2PST-NO)	3.0 W / 0.5 W
Temperature Rise	70 K (126°F) at holding voltage (at 85°C)
Max. temperature	class F insulation - 155°C (311°F)

GENERAL DATA

Life Expectancy	(minimum operations)
mechanical	2×10^5 cycles
electrical	see section *Rated Loads*
Timing	(max. / typ.)
operate time	40 ms / < 35 ms (at nominal coil voltage at 23°C)
release time	10 ms / < 4 ms (without coil suppression)
Dielectric Strength	(at sea level for 1 min.)
open load contacts	2 kV_{RMS}
load contacts sets	3 kV_{RMS}
coil and load contacts	5 kV_{RMS}
load and monitor contacts	5 kV_{RMS}
open monitor contacts	1 kV_{RMS}
coil and monitor contacts	1 kV_{RMS}
Short circuit performance	
IEC 62955 / IEC 61008-1	U_e= 480 V; I_n= 32 A; $I_{nc}/I_{\Delta c}$= 10 kA; (seq. E, F)
IEC 62052-11 cl. 9.4.10	U_n= 480 V; I_{max}= 32 A; overcurrent = 30 × I_{max}
	Note: Short circuit performance tested at TÜV.
Surge Voltage	10kV @1.2/50µs (coil to load contacts)
Insulation Distances	(clearance / creepage)
open load contacts	≥ 4.0 mm / ≥ 11.5 mm
load contacts sets	≥ 8.6 mm / ≥ 8.9 mm
coil to load contacts	≥ 9.4 mm / ≥ 10.5 mm
load to monitor contacts	≥ 10.0 mm / ≥ 10.5 mm
coil to monitor contact	≥ 4.0 mm / ≥ 4.8 mm
Insulation Type	
coil/monitor to load contacts	230/400V, Reinforced insulation, PD 2, OVC III 480V, Basic insulation, PD3, OVC III
	UL: Suitable where overvoltage protection for a rated impulse withstand voltage peak of 6 kV is provided.
Temperature Range	(at holding coil voltage)
operating and storage	-40°C (-40°F) to 95°C (203°F)
Vibration	0.062" (1.5 mm) DA at 10–55 Hz
Shock	10 g (functional) / 100 g (destructive)
Enclosure	PBT polyester
protection category	flux proof (RTII) / plastic sealed
material group	IIIa
flammability	UL94 V-0
Terminals	Tinned copper alloy, THT PCB mounting
Soldering	(referring IEC 61760-1 wave soldering)
preheating	120°C (248°F) / ≤ 120 s
soldering	260 ±5°C (500 ±9°F) / ≤ 2 × 5 s
Dimensions and Weight	58.6 mm × 35.0 mm × 45.3 mm, 180 grams
Compliance	UL 508, CSA C22.2, IEC 61810-1, GB/T 21711.1-2023, RoHS, REACH
Agency Approvals	
TÜV	R 50672404
UL/CUR	E365652
CQC	CQC25002465625
Packing (pcs.)	5 per plastic tube 60 per carton box

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AZEV400

COIL VOLTAGE SPECIFICATIONS

Voltage [VDC]				Resistance [Ω] ±10%	
nominal	must operate	min. holding	max.	2-pole type (3.0 W coil)	4-pole type (4.8 W coil)
6	4.5	2.4	6.6	12.0	7.5
9	6.7	3.6	9.9	27.0	16.9
12	9.0	4.8	13.2	48.0	30.0
24	18.0	9.6	26.4	192.0	120.0

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) To avoid overheating at elevated ambient temperatures, we recommend to operate the coil at 55 - 70% of nominal coil voltage after applying the full nominal coil voltage for ≥200 ms.
4) Preferred coil voltages in bold face numbers.

ORDERING DATA

AZEV400-□AE□□□-□□D□□□□

Special options
nil: standard version
(xxx): special code suffix

Sealing option
nil: flux proof (RTII)
E: plastic sealed version

Nominal coil voltage
see coil voltage specifications table

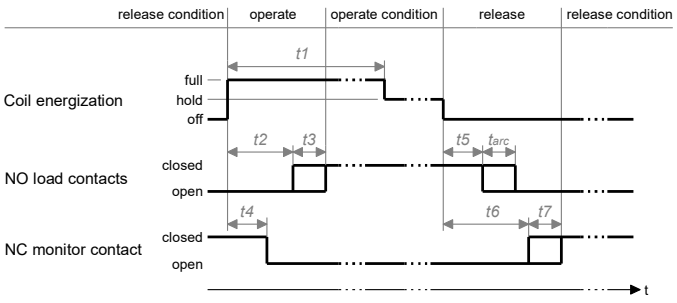
Monitor contact
nil: without monitor contact
1BG: equipped with 1 Form B monitor contact

Contact arrangement
2: 2-pole type (2PST-NO)
4: 4-pole type (4PST-NO)

Example ordering data

AZEV400-4AE1BG-12D	4-pole type, with monitor contact, 12V/4.8W coil
AZEV400-2AE1BG-24D	2-pole type, with monitor contact, 24V/3W coil

TIMING DIAGRAM



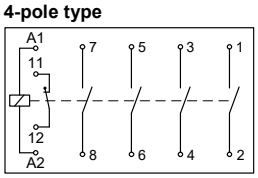
Item	Description	Notes	Timing [ms] min.	typ.	max.
t1	Full energization time	recommended value for reference	200	-	-
t2	NO operate time	at nominal coil voltage (at 23°C) [1]	-	< 35	40
		at nominal coil voltage (at hot coil) [2]	-	< 80	100
t3	NO bounce time	at nominal coil voltage	-	< 4	-
t4	NC operate time	at nominal coil voltage (at 23°C) [1]	-	< 30	40
		at nominal coil voltage (at hot coil) [2]	-	< 75	100
t5	NO release time	without coil suppression	-	< 4	10
		with suppression $U_{BR}/U_{nom.}$ = 2 [3]	-	< 6	-
t6	NC release time	with suppression $U_{BR}/U_{nom.}$ = 2 [3]	-	< 8	10
t7	NC bounce time		-	< 15	-
t_{arc}	arcing duration	if released under load, dependent on actual load			

Notes:
1) Cold coil at ambient temperature of 23°C
2) Hot coil with relay operated at max. temperature.
3) Coil suppression breakdown voltage U_{BR} twice the nominal coil voltage $U_{nom.}$ E.g. 24V transient voltage suppressor diode in parallel to 12V coil.

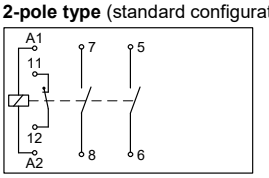
WIRING DIAGRAM

Viewed from bottom side towards terminals.

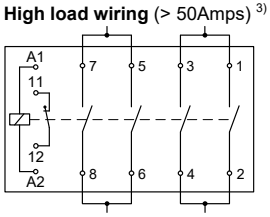
4-pole type



2-pole type (standard configuration) [2]



High load wiring (> 50Amps) [3]

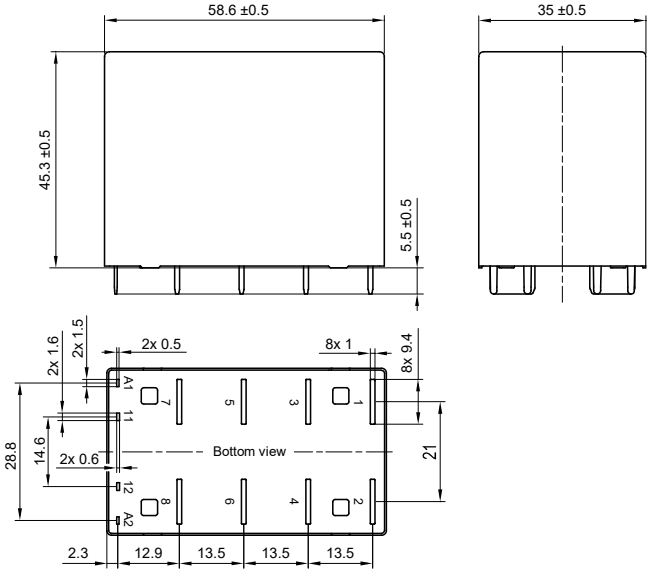


Pin	Description
1, 2	NO load contact set A
3, 4	NO load contact set B
5, 6	NO load contact set C
7, 8	NO load contact set D
11, 12	NC monitor contact
A1	Coil end - winding outer layer
A2	Coil start - winding inner layer

Notes:
1) Pins 11 and 12 are omitted for versions without 1 Form B monitor contact.
2) Contact sets *A* and *B* (pins 1, 2, 3, 4) are omitted for the 2-pole standard types. Options with other contact configurations are available on request.
3) For load current greater than 50 Amps, load contact sets must be connected in parallel to share the load current. A parallel connection of contact sets A with B and contact sets C with D is required on the PCB.
4) Versions with FILO option (First-In-Last-Out) available on request. See section *Special Options* for details.

MECHANICAL DATA

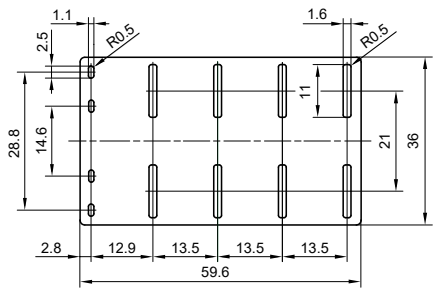
Dimensions in mm. Tolerance ±0.3mm if not stated otherwise. Illustration shows 4-pole type.
Notes:
1) Pin outline dimensions for reference only and given without tin coating.
2) Pins 11 and 12 are omitted for versions without 1 Form B monitor contact.
3) Pins 1, 2, 3 and 4 are omitted for 2-pole standard types. Other options on request.



CAD data in attachment of the datasheet.

PCB FOOTPRINT

Layout and footprint recommendation. Dimensions in mm. Illustration shows 4-pole type.



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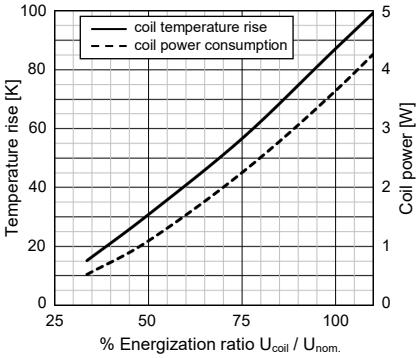
SPECIAL OPTIONS

These components allow for special options and configurations by suffix codes upon request. The following list shows examples of some special options.

Suffix code	Description
0N1	FILO on contact set A (pins 1, 2). Contact set A with slightly lower contact gap than contact sets B, C and D.
0N3	FILO on contact set B (pins 3, 4). Contact set B with slightly lower contact gap than contact sets A, C and D.
0N5	FILO on contact set C (pins 5, 6). Contact set C with slightly lower contact gap than contact sets A, B and D.
0N7	FILO on contact set D (pins 7, 8). Contact set D with slightly lower contact gap than contact sets A, B and C.
117	2-pole type equipped with contact sets A (pins 1, 2) and D (pins 7, 8). Contact sets B and C omitted.

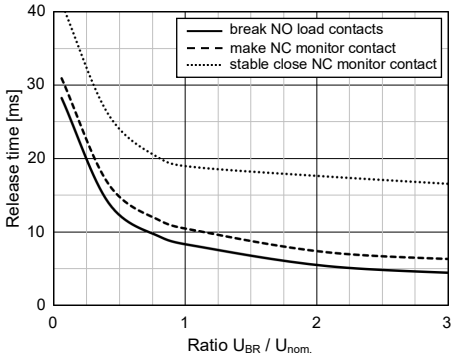
CHARACTERISTICS

Coil temp. rise vs. energization - 4-pole type



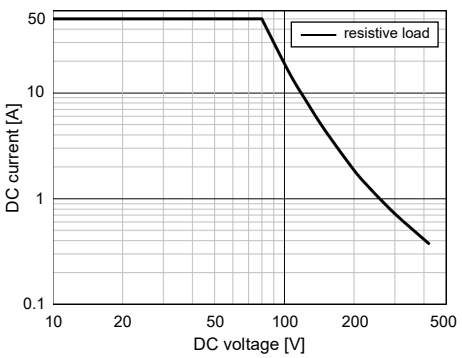
Typical coil temperature rise and coil power consumption as a function of the applied coil voltage. The data refers to the 4-pole type in thermal equilibrium at 23°C ambient temperature without contact load.

Release time vs. suppressor breakdown voltage (typ.)



Typical release timing as a function of the coil's suppression circuit breakdown voltage. X-axis shows the ratio between the suppression circuit breakdown voltage and the nominal coil voltage.

DC breaking capacity - single NO load contact set



DC current breaking capacity as a function of switching voltage for resistive loads. The data are based on an arc duration of ~3.5 ms, tested at 23±5°C at sea level, and a coil suppression with breakdown voltage of 2 times the rated coil voltage.

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, H2S, SO2, NO2, 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.
8. Do not use these relays in environments with explosive or flammable gases. Electrical arcing at the contacts could ignite these gases and cause fire.
9. 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.
10. 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.
11. 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.
12. Avoid high frequency or ultrasonic vibrations on the relays as these can cause contact welding and misalignment or destruction of internal structures.
13. 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.

continued on next page

NOTES (cont'd)

Design guidelines

14. The relay may pull in and operate with less than the specified *must operate* voltage value.
15. 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.
16. At elevated ambient temperatures, after applying the rated nominal coil voltage for ≥ 200 milliseconds, the coil energization must be reduced to a holding level in order to reduce thermal stress and prevent the coil from overheating.
17. 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.
18. For short-circuit performance according IEC62955, IEC61008-1 or IEC62752, 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.
19. 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 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.
20. 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.
21. 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.
22. 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.
23. For load current greater than 50 Amps, the load contact sets must be connected in parallel to share the load current. See section *Wiring Diagram* for details.
24. A minimum load of 10 mA / 5 V / 50 mW is recommended for the gold plated monitor contact to ensure a reliable and stable electrical connection.
25. As with any contact mechanism, the relay's NC monitor contact bounces when switching. For evaluation of its signal, suitable debouncing measures must be taken to get a reliable signal.

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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