

## Description

The Smart Power Relay E-1048-8I.- is a remotely controllable electronic load disconnecting relay with three functions in a single unit:

- electronic relay
- electronic overcurrent protection
- status indication

The 7 pin INLINE version is designed for use with various E-T-A terminal blocks, e. g. 17-P10-Si. A choice of current ratings is available from 1 A through 20 A. An operating voltage range of DC 9...32 V allows the connection of DC 12 V and DC 24 V loads.

In order to switch and protect loads remotely, it has until now been necessary to connect several discreet components together:

- an electro-mechanic relay, control cable and integral contact to close the load circuit
- an additional protective element (circuit breaker or fuse) for cable or equipment protection
- a device for current measurement (shunt)

**Now type E-1048-8I. combines all these functions in a single unit, thus minimising the number of connections in the circuit and thereby reducing the risk of failures.**

## Applications

Type E-1048-8I. is suited to all applications with DC 12 V or DC 24 V circuits, where magnetic valves, motors or lamp loads have to be switched, protected or monitored:

- road vehicles (utility vehicles, buses, special vehicles)
- rail vehicles
- marine industry (ships, boats, yachts etc.)

The Power Relay is also suitable for industrial use (process control, machine-building, engineering) as an electronic coupling relay between PLC and DC 12 V or DC 24 V load

## Features

- Integral power electronics provide a wear-resistant switching function, insensitive to shock and vibration.
- Only a fraction of the control power needed by electro-mechanical relays is required for switching loads. This is important for battery buffered load circuits which have to remain controlled even with the generator off line.
- The extremely low induced current consumption of less than 1 mA is absolutely necessary for battery buffered applications.
- The load circuit is disconnected in the event of an overload or short circuit, the trip curve is also suitable for smaller motor loads.
- The load circuit is permanently monitored for wire breakage.
- Two status outputs for control signal AS and group signal SF provide status indication. For processing the actual value of the current flow in a power management system an analogue output from 0 to 5 V is provided. This voltage signal may also be used as an input to a control circuit or to switch off the unit by means of external control in the event of low load current value.
- For switching and monitoring loads of 20 A plus it is possible to connect several units in parallel. Uniform power distribution between units must be ensured by symmetrical design of the supply cables (length and cross section).
- Coloured label, e. g. red = 10 A, see ordering information.



**E-1048-8I. INLINE**

## Technical Data ( $T_U = 25^\circ\text{C}$ , $U_S = \text{DC } 24\text{ V}$ ) ( $T_U =$ ambient temperature at $U_N$ )

### Power supply LINE +

Type	DC power supply with small $R_i$ battery and generator etc.
Voltage ratings $U_N$	DC 12 V / DC 24 V
Operating voltage $U_S$ :	DC 9...32 V

### Load circuit LOAD

Load output	Power MOSFET, high side switching
Max. current rating $I_N$	20 A
Types of loads	resistive, inductive, capacitive, lamp loads, motors (depending on duration of inrush current)
Current rating range $I_N$	1 A...15 A (fixed ratings) up to $85^\circ\text{C}$ ambient without load reduction, 20 A up to $70^\circ\text{C}$ . Two basic versions with factory pre-set ratings: version 1: 1 A/2 A/3 A/5 A/7.5 A/10 A version 2: 15 A / 20 A

Induced current consumption  $I_0$  of the unit (OFF condition) < 1 mA

Typical voltage drop  $U_{ON}$  at rated current  $I_N$  (at  $25^\circ\text{C}$ )

$I_N$	$U_{ON}$	$I_N$	$U_{ON}$
1 A	50 mV	7.5 A	90 mV
2 A	55 mV	10 A	110 mV
3 A	60 mV	15 A	60 mV
5 A	80 mV	20 A	60 mV

Switching point typically  $1.3 \times I_N$   
( $-40^\circ\text{C}$ ... $+85^\circ\text{C}$ :  $1.1...1.5 \times I_N$ )

Trip time (standard curve) typically 200 ms with switch-on onto overload and/or load increase on duty

Current limitation  
version 1: typically 75 A  
version 2: typically 350 A

Temperature disconnection power transistor >  $150^\circ\text{C}$   
After trip  
- resettable via external control signal (low-high) at control input IN+  
- reset of supply voltage

Parallel connection of channels for loads of 20 A plus, several units of identical current ratings may be connected in parallel. To ensure equal distribution of current between units, symmetrical design of the supply feed is necessary (length and cross section).

Leakage current in OFF condition  
version 1: max. 100  $\mu\text{A}$   
version 2: max. 500  $\mu\text{A}$

Free-wheeling diode for connected load  
integral  
version 1: max. 40 A  
version 2: max. 100 A

## Technical Data ( $T_U = 25\text{ °C}$ , $U_S = \text{DC } 24\text{ V}$ ) ( $T_U = \text{ambient temperature at } U_N$ )

Delay time $t_{on} / t_{off}$ (resistive load)	typically 5 ms / typically 1.5 ms (EMC filter in control input)
Wire breakage monitoring in ON and OFF condition of load	<p>wire breakage thresholds:</p> <p>in OFF-condition (version 1): <math>R_{load} &gt; \text{typically } 100\text{ k}\Omega</math></p> <p>in OFF-condition (version 2): <math>R_{load} &gt; \text{typically } 10\text{ k}\Omega</math></p> <p>in ON-condition: <math>I_{load} &lt; \text{typically } 0.2 \times I_N</math></p> <p>indication via group fault signalisation FM (switching output)</p> <p>Fault indication will not be stored, i.e. after remedy of wire breakage fault indication will disappear</p> <p>(possible options:</p> <ul style="list-style-type: none"> <li>- wire breakage indication only in ON condition</li> <li>- wire breakage indication only in OFF condition</li> <li>- no wire breakage indication)</li> </ul> <p>- disconnection of load, indication via group signal SF</p> <ul style="list-style-type: none"> <li>- no automatic re-start</li> <li>- after remedy of the fault unit has to be reset via control input IN+</li> </ul>
Short circuit, overload in load circuit	<ul style="list-style-type: none"> <li>- disconnection of load, indication via group signal SF</li> <li>- no automatic re-start</li> <li>- after remedy of the fault unit has to be reset via control input IN+</li> </ul>

### Control input IN+

Control voltage IN+	0...5 V = "OFF", 8.5...32 V = "ON"
Control current $I_E$	1...10 mA (8.5...DC 32 V)
Reset in the event of a failure	- reset via external control signal (low - high) at control input IN+ - via reset of supply voltage
Dimmer operation (e.g. PWM signal)	possible, see max. switching frequency

Switching frequency at resistive or inductive load max. 100 Hz

### Status and diagnostic function

<b>Control signal AS</b>	transistor output minus switching (LSS), open collector, short circuit and overload proof, max. load: DC 32 V/2 A 0 V-level: when unit is set (at IN+ = 8.4...32 V)
<b>Group signal SF</b>	transistor output minus switching (LSS), open collector, short circuit and overload proof, load max. DC 32 V/2 A 0 V-level with overload and short circuit disconnection, wire breakage indication voltage output 0-5 V proportional to load current: $1\text{ V} = 0.2 \times I_N$ $5\text{ V} = 1.0 \times I_N$ 5 V... typically 6.5 V = overload range tolerance: (for $I_{load} > 0.2 \times I_N$ ) $\pm 8\%$ of $I_N$ max. output current 5 mA load resistance $> 1\text{ k}\Omega$ against GND
<b>Analogue output U(I)</b>	response time when switching on a load: $t_{90} = \text{typically } 20\text{ ms}$ response time of load change on duty: $t_{90} = \text{typically } 1\text{ ms}$
Trip times definition of $t_{90}$ reached 90% of final value	

### Visual status indication

Control signal AS	LED yellow
Group fault signal SF	LED red

## Technical Data ( $T_U = 25\text{ °C}$ , $U_S = \text{DC } 24\text{ V}$ ) ( $T_U = \text{ambient temperature at } U_N$ )

### General data

#### Reverse polarity protection

Control circuit	yes
Load circuit	no (due to integral free-wheeling diode)
Status outputs	interference voltage resistance max. DC 32 V

### Temperature range

ambient temperature	- standard: -40...+85 °C without load reduction (70 °C at 20 A) - for other temperature ranges please see ordering key
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### Tests

Humid heat	combined test, 9 cycles with functional test test to DIN EN 60068-2-30, Z/AD
Temperature change	min. temperature -40 °C, max. temperature +90 °C test to DIN IEC 60068-2-14, Nb
Vibration (random)	in operation, with temperature change 6 g eff. (10 Hz...2,000 Hz) test to DIN EN 60068-2-64
Shock	25 g/11 ms, 10 shocks test to DIN EN 60068-2-27
Corrosion	test to DIN EN 60068-2-52, severity 3
Protection class	housing IP30 to DIN 40050 higher protection class upon request
EMC requirements	EMC directive: emitted interference EN 50081-1 noise immunity EN 61000-6-2 Automotive directive: emitted interference, noise immunity: 72/245/EW6 und 95/54/E6

### Terminals of INLINE version (7 pin, standard)

Mounting:	7 blade terminals 6.3 mm x 0.8 mm to DIN 46244-A6.3-0.8 contact material CuZn37F37 copper-plated and tin-plated - E-T-A socket type 17-P10-Si <b>(max. load 16 A)</b> - on a pc board with 6.3 mm receptacles
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### Housing

max. dimensions	INLINE: 11.5 x 50 x 56 mm when plugged in 11.5 x 50 x 66 mm including terminals
Materials	INLINE: Ultramid
Mass	approx. 23 g...33 g, depending on version

### Approvals CE, e1 logo

according to EU, EMC and automotive directives

## Ordering Information

### Type

**E-1048-8I** Smart Power Relay DC 12 V/24 V - 1 A...20 A in INLINE housing

### Housing / temperature range

- 3** with housing / 70 °C (without moisture condensation)
- 4** with housing / -40 °C...+85 °C (70 °C at I<sub>N</sub> = 20 A)

**C** with control input (+ control 8.5...32 V)

### LEDs

- 0** without LEDs
- 3** 2 LEDs: AS yellow, SF red

### Status output minus-switching

- A** without
- D** with AS and SF

### Contents of group fault signal SF/ LED indication SF

- 0** without
- 1** short circuit / overload
- 2** short circuit / overload + wire breakage off
- 3** short circuit / overload + wire breakage on
- 4** short circuit / overload + wire breakage off + wire breakage on

### Analogue output

- V0** without
- V1** 0...5 V

### Characteristic curve

- 4** 200 ms (switch-off delay with overload)

### Voltage rating

**U3** DC 12/24 V

### Current ratings / colour of label

- 1 A** / black
- 2 A** / grey
- 3 A** / purple
- 5 A** / light-brown
- 7.5 A** / brown
- 10 A** / red
- 15 A** / blue
- 20 A** / yellow

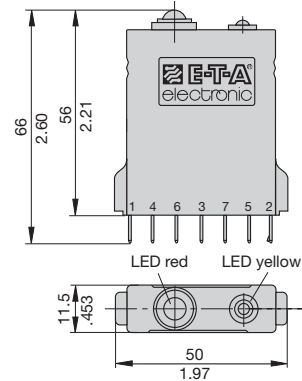
**E-1048-8I 4 - C 3 D 4 V1-4 U3 - 20 A**

ordering example 1: (all options = "DELUXE")

**E-1048-8I 3 - C 0 A 0 V0-4 U3 - 5 A**

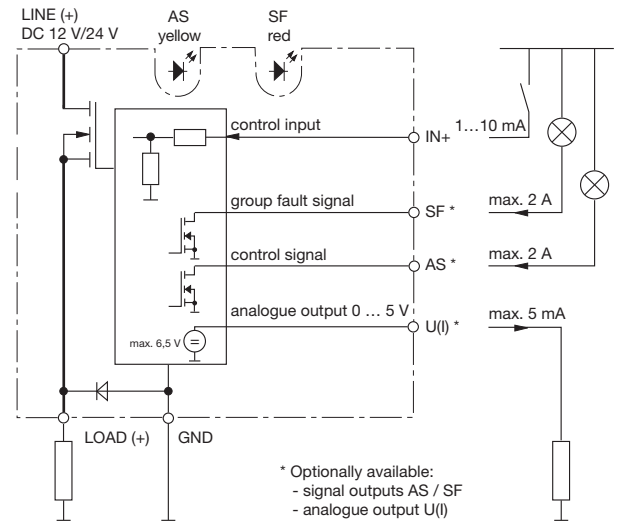
ordering example 2: (without options = "BASIC")

## Dimensions



This is a metric design and millimeter dimensions take precedence ( $\frac{\text{mm}}{\text{inch}}$ )

## Connection diagram

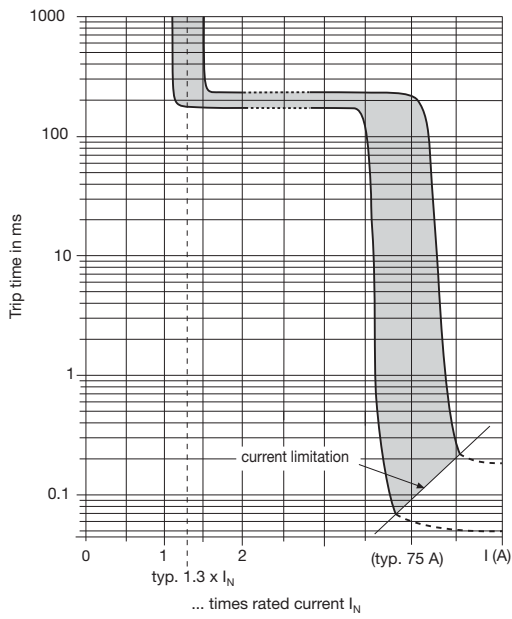


## Pin selection

E-1048-8I.	17-P10-Si	
LINE + (2)	(2) [2(k)]	
GND (5)	(5) [12]	
SF (7)	(7) [24]	
U(I) (3)	(3) [2(i)]	
AS (6)	(6) [23]	
IN+ (4)	(4) [11]	
LOAD (1)	(1) [1]	

## Typical time/current characteristics ( $T_A = 25\text{ °C}$ )

**Version 1:** 1 A, 2 A, 3 A, 5 A, 7.5 A and 10 A (standard 200 ms)



**Version 2:** 15 A and 20 A (standard 200 ms)

