

Article  from revision   
 Description

Device category 2 - electrical article with relay

Prediction done by: pykp03

at  °C with  % duty cycle      based on       Environmental condition       MTTF in h       MTTF in a       failure rate in FIT (λ basis)

**MTTF values and failure rates - relay contact -, details according to SN 29500-7**

ambient temperature in °C	type of load	type of voltage	voltage in V	current in A	operating cycles per h	failure criteria	failure rate in FIT (λ contact)	MTTF in h	MTTF in a
40	resistive	DC	>0,5	<0,1	360	normal	360	2777777,78	317,1
40	resistive	AC	>13	>0,1	360	normal	36	27777777,78	3170,98
40	resistive	DC	>13	>0,1	360	normal	180	5555555,56	634,2
40	inductive	AC	>13	>0,1	360	normal	360	2777777,78	317,1
40	inductive	DC	>13	>0,1	360	normal	900	1111111,11	126,84
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Notes for device category 2 (electrical article with relay)

- failure rates (  $\lambda$  ) respectively MTTF values (rounded)
- One changeover contact counts as two contact
- One double contact counts as one contact
- Optional spark-extinguished contacts behave like contacts on ohm resistive load at the same current load
- Standardized load characteristic diagrams are shown in diagramm

The failure rate respectively the MTTF value of the relay can be calculated with the following formula  
**Only used contacts have to be considered!**

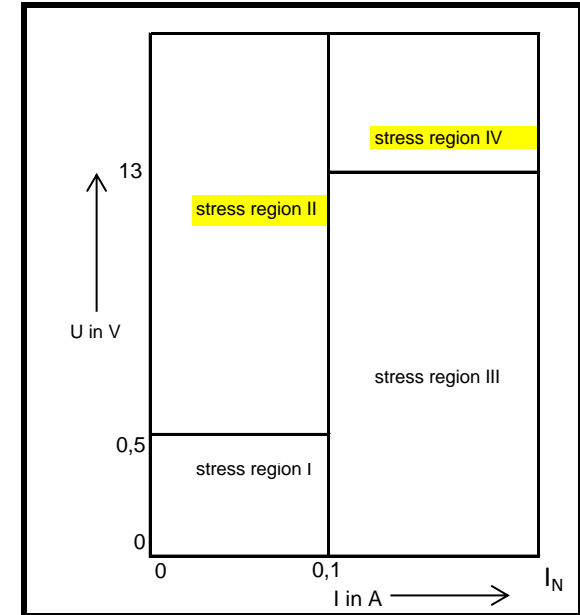
Calculation of total failure rate,  $\lambda$  device (FIT)

$$\lambda_{device} = \lambda_{basis} + \sum \lambda_{contact}$$

Calculation of total MTTF value, MTTF device (h)

$$MTTF_{device} = \frac{10^9 h}{\lambda_{device}}$$

Diagram



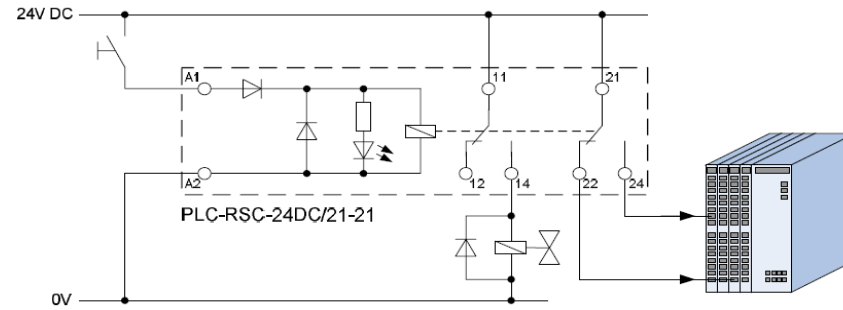
## Example of a MTTF calculation for an electronic article with relay (e.g. relay modul)

### 1. Product

Relay module with 2 changeover contacts: PLC-RSC-24DC/21-21 (Art.-No. 2967060)



### 2. Application setup



### 3. Information about contact load

Load 1 at contact 1 (only NC of the changeover contact is used):  
Solenoid valve 24VDC / 1 A, wired up with freewheeling diode

Load 2 at contact 2 (change over contact is used):  
Electronical control input, 24VDC / 10mA (resistive load)

### 4. Result lists of the failure rates $\lambda$

(relevant values for this example are highlighted in grey)

$\lambda$  basic Failure rate for the electronic share (LED, freewheeling diode, polarity protection etc.) and e.g. the connections of the relay modul  
 $\lambda$  contact Failure rate for one single contact of the relay module for different typical contact loads

#### Failure rate $\lambda$ basic

at <input type="text" value="40"/> °C with <input type="text" value="100,00"/> % duty cycle	based on <input type="text" value="SN 29500"/>	Environmental condition <input type="text" value="GB, GC - Ground Benign, Controlled"/>	MTTF in h <input type="text" value="23310023,31"/>	MTTF in a <input type="text" value="2660,96"/>	failure rate in FIT ( $\lambda$ basis) <input type="text" value="42,9"/>
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#### Failure rate $\lambda$ contact

ambient temperature in °C	type of load	type of voltage	voltage in V	current in A	operating cycles per h	failure criteria	failure rate in FIT ( $\lambda$ contact)	MTTF in h	MTTF in a
40	resistive	DC	>0,5	<0,1	360	normal	360	2777777,78	317,1
40	resistive	AC	>13	>0,1	360	normal	36	2777777,78	3170,98
40	resistive	DC	>13	>0,1	360	normal	180 (1)	5555555,56	634,2
40	inductive	AC	>13	>0,1	360	normal	360	2777777,78	317,1
40	inductive	DC	>13	>0,1	360	normal	900	1111111,11	126,84

(1) A freewheeling diode at load 1 represent an ideal contact protection circuit at an inductive DC load and the inductive share of the load. -> Select value for resistive load!

### 5. Calculation of the MTTF for the whole relay modul

$\lambda$  device =  $\lambda$  basic +  $\sum$   $\lambda$  contact -> in this example: ->  $\lambda$  device =  $\lambda$  basic +  $\lambda$  contact 1 +  $\lambda$  contact 2

Entry of the values from the result lists

$$\lambda_{device} = 42,9 \text{ FIT} + 180 \text{ FIT} + (2^{(2)} \times 360 \text{ FIT}) = 942,9 \text{ FIT}$$

(2) 2 x table value, because a changeover contact is considered as two contacts

$$MTTF_{device} = \frac{10^9 \text{ h}}{\lambda_{device}} = \frac{10^9 \text{ h}}{942,9} = 1060558 \text{ h} = 121 \text{ years}$$