



RELAYS

MULTIFUNCTION MULTISCALE TIMER DELAY WITH 4 CONTACTS

TMM SERIES

USER SECTORS



Power generation



Nuclear



Power transmission



Rolling Stock



Fixed railway installations



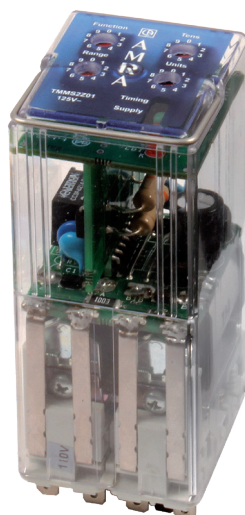
Shipbuilding



Petroleum industry



Heavy industry



TMM

PRODUCT ADVANTAGES

- Plug-in relay with time delay, multifunction
- 10 different time delay functions
- 4 time delay contacts or 2 time delay contacts + 2 instantaneous contacts
- Wide time setting range from 0.1s to 99 hours, extreme accuracy across the adjustment range
- High electromagnetic interference immunity
- Solid and rugged construction for heavy or intensive duty
- Long life expectancy
- Independent and self-cleaning contacts
- Magnetic arc blow-out standard
- Separate arc breaking chambers
- Excellent shock and vibration resistance
- Wide range of sockets
- Wide variety of configurations and customizations
- Retaining clip for secure locking of relay on socket
- Transparent cover, pull-out handle
- Positive mechanical keying for relay and socket

DESCRIPTION

The **TMM series** is a range of multifunction relays with electronic time delay, consisting of 2 models with 4 change-over contacts, rated 10 A (nominal). They are obtained by assembling the electromechanical units of the POKS series with a digital electronic circuit. The electromechanical part features the **reliability and ruggedness of relays belonging to the POKS series**, while the electronics offers high reliability thanks to the use of a circuit requiring few components and to the careful choice of professional products.

A single TMM series relay offers **10 different timer functions, freely programmable** by the user; these include, by way of example, time delay on pick-up or on drop-out, flasher, one-shot, etc.

The switching time can be selected within a wide range extending from 0.1 second to 99 hours, with **extreme accuracy** guaranteed across the full scale of adjustment. This is made possible by providing the relay with **10 intermediate scales**.

The timer function, the scale and the switching time are adjustable by means of 4 rotary switches, each having 10 positions, located on the front of the relay.

The electronic circuit is immune to high electromagnetic interference, typical of high voltage electricity distribution stations. The construction of the relays and careful choice of the materials are such that they ensure long life and considerable ruggedness even in harsh operating environments and in the presence of strong temperature fluctuations.

Excellent electrical and mechanical performance levels allow the product to be used in the most demanding of sectors such as, for example, rail transport, control and signalling functions in electricity generating stations, electrical transformer stations, or in industries with continuous production processes (chemical and petroleum industries, rolling mills, cement factories, etc.). Above all, the excellent ability to withstand shock and vibration allow their use on rolling stock.

Models	Nominal current	Number of contacts		Rolling stock application
		Time-delayed	Instantaneous	
TMM2	10 A	2	2	•
TMM4	10 A	4	-	•

FOR CONFIGURATION OF PRODUCT CODE, SEE "ORDERING SCHEME" TABLE

Coil specifications	
Nominal voltages Un ⁽¹⁾	DC: 12-24-36-48-72-110-125-132-144-220 AC: 12-24-48-110-127-220-230
Max. consumption at Un (DC/AC)	TMM2: 5.5 W / 7.5 VA TMM4: 4.5 W / 6.5 VA
Operating range ⁽¹⁾	80 ÷ 115 % Un
Rolling stock version ^{(2) (3)}	DC: 70 ÷ 125 % Un
Type of duty	Continuous
Drop-out voltage ⁽⁴⁾	> 15% Un

(1) Other values on request.

(2) See "Ordering scheme" table for order code.

(3) For operating ranges different to that specified by EN60077, refer to table "Rolling stock versions - Special Ranges".

(4) Limit value for supply voltage, expressed as % of the nominal value, beneath which the relay is certainly de-energized.

Contact specifications		TMM2	TMM4
Number and type		2 timed + 2 instantaneous CO, form C	4 timed, CO, form C
Current	Nominal ⁽¹⁾	10 A	
	Maximum peak (1 s) ⁽²⁾	20 A (1 min) / 40 A (500 ms)	
	Maximum pulse (10 ms) ⁽²⁾	150 A	
Example of electrical life expectancy ⁽³⁾		0.7 A – 132 Vdc – L/R 40 ms: 10 ⁵ operations 1 A – 110 Vdc – L/R 0 ms: 10 ⁵ operations	
Making capacity		30 A (for 200 ms) – 110 Vdc – L/R 0 ms: 2,000 operations	
Minimum load	Standard contacts	500 mW (20 V, 20 mA)	
	Gold-plated contact P4GEO ⁽⁴⁾	100 mW (10 V, 5 mA)	
	Gold-plated contact P8 ⁽⁴⁾	50 mW (5 V, 5 mA)	
Maximum breaking voltage		250 Vdc / 350 Vac	
Contact material		AgCu	
Operating time at Un (ms) ^{(5) (6)}	Pick-up (NO contact closing)	DC ⁽⁷⁾ – AC ≤ 20 - ≤ 20	
	Drop-out (NC contact closing)	≤ 15 - ≤ 20	

(1) On all contacts simultaneously, reduction of 30%.

(2) The max. peak and pulse currents are those currents that can be handled, for a specified time, by the contact. They do not refer to steady or interrupted currents.

(3) For other values, see electrical life expectancy curves.

(4) Specifications of contacts on new relay

a) Plating material: P4 GEO: gold-nickel alloy (>6μ) P8: gold-cobalt alloy (>5μ), knurled contact

b) When the gold-plated contact is subject to heavy loads, it will be degraded on the surface. In such case, the characteristics of the standard contact should be taken into consideration. This does not impair relay operation.

(5) Times for the instantaneous component of the relay (TMM2 model).

(6) Unless specified otherwise, the operating time signifies until stabilization of the contact (including bounces). They should be added to the preset delay time.

(7) Addition of a flyback diode connected in parallel with the coil (DC version only) causes an increase in operating time when the relay drops out.

Insulation	
Insulation resistance (at 500Vdc)	
between electrically independent circuits and between these circuits and ground	> 1,000 MΩ
between open contact parts	> 1,000 MΩ
Withstand voltage at industrial frequency	
between electrically independent circuits and between these circuits and ground	2 kV (1 min) - 2.2 kV (1 s)
between open contact parts	1 kV (1 min) - 1.1 kV (1 s)
between adjacent contacts	2,5 kV (1 min) - 3 kV (1 s)
Impulse withstand voltage (1.2/50μs - 0.5J)	
between electrically independent circuits and between these circuits and ground	5 kV
between open contact parts	3 kV



Mechanical specifications

Mechanical life expectancy	10 x 10 ⁶
Maximum switching rate	Mechanical 3,600 operations / h
Degree of protection (with relay mounted)	IP40
Dimensions (mm) ⁽¹⁾	40 x 50 x 97
Weight (g)	~ 220

(1) Excluding output terminals



Environmental specifications

Operating temperature	Standard -25 ÷ + 55 °C
	Rolling stock version -25 ÷ + 70 °C
Storage and shipping temperature	-40 ÷ + 70 °C
Relative humidity	Standard: 75% RH, Tropicalized: 95% RH
Resistance to vibrations	5 g - 10 ÷ 55 Hz - 1 min
Resistance to shock	20 g - 11 ms
Fire behavior	V0



Standards and reference values

EN 61810-1, EN 61810-2, EN 61810-7 EN 61812-1 EN 60695-2-10 EN 50082, EN 61000-4 EN 60529	Electromechanical elementary relays Timer relays Fire behavior Electromagnetic compatibility Degree of protection provided by enclosures
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Unless otherwise specified, the products are designed and manufactured according to the requirements of the above-mentioned European and International standards.
In accordance with EN 61810-1, all technical data are referred to ambient temperature of 23°C, atmospheric pressure of 96kPa and 50% humidity.
Tolerance for coil resistance, nominal electrical input and nominal power is ±7%.



Railways, rolling stock - Standards

EN 60077 EN 50155 EN 61373 EN 45545-2 ASTM E162, E662	Electric equipment for rolling stock - General service conditions and general rules Electronic equipment used on rolling stock Shock and vibration tests, Cat 1 Class B Fire behavior, Cat E10, Requirement R26, V0 Fire behavior
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Railways, rolling stock – Special operating ranges⁽¹⁾

Nominal voltage	Minimum pick-up voltage	Maximum operating voltage	Order symbol ⁽¹⁾
24 Vdc	16.8	32	Z01
72 Vdc	55	104	Z01
110 Vdc	77	144	Z01

(1) To request the special range, indicate the "Z0x" symbol in the "Keying position" field in the "Ordering scheme" table. The special range may be subject to operating specifications different from standard specifications. Please contact us for further information.



Configurations - Options

P2	Tropicalization of coil with epoxy resin for exposure to 95% RH (@ T 50 °C). This treatment also protects the coil against corrosion which could occur by combination of the humidity with certain chemical agents, such as those found in acidic or saline atmospheres.
P4GEO	Gold plating of contacts with gold-nickel alloy, thickness ≥ 6μ. This treatment ensures long-term capacity of the contact to conduct lower currents in harsh ambient conditions such as acid atmospheres (typical of geothermal power stations) or saline atmospheres.
P5GEO	Gold-plating of contacts P4GEO + tropicalization of coil P2 .
P6GEO	P4GEO type gold-plating, but applied to contacts, contact terminals and output terminals + P2 coil tropicalization.
P7	AgCdO (silver cadmium oxide) contacts.
P8	Gold plating of contacts with gold-cobalt alloy, thickness ≥ 5μ, knurled fixed contact. This finish allows further improvement of the gold-plated contact performance compared to the treatment P4GEO.
FLYBACK DIODE	Polarized component connected in parallel with the coil (type 1N4007 or BYW56 for rolling stock version) designed to suppress overvoltages generated by the coil when de-energized.
TRANSIL	Non-polarized component connected in parallel with the coil. Behavior is similar to that of a varistor, with faster operating times.



Ordering scheme

Product code	Application ⁽¹⁾	Configuration A	Configuration B	Label	Type of power supply	Nominal voltage (V) ⁽²⁾	Keying position ⁽³⁾
TMM2	E: Energy Railway Fixed Equipment	1: Standard 2: Diode //	0: Standard 2: P2 4: P4 GEO 5: P5 GEO 6: P6 GEO 7: P7 8: P8	F	C: Vdc A: Vac 50 Hz	012 - 024 - 036 048 - 072 - 100 110 - 125 - 127 132 - 144 - 220 230	XXX
TMM4	R: Railway Rolling Stock	3: Varistor 7: Transil					

Example

TMM2	E	1	8	F	C	024	
TMM2E18F-C024 - TMM2 relay, ENERGY series, nominal voltage 24 Vdc, with P8 finish (gold-plated contacts)							
TMM4	R	1	0	F	C	110	
TMM4R10F-C110 - TMM4 relay, ROLLING STOCK series, nominal voltage 110 Vdc							

(1) **E = ENERGY:** all applications, except for railways rolling stock.

Suitable on energy production, transport and distribution plants, railways fixed equipment, petrolchemical and heavy industry.

R = RAILWAYS, ROLLING STOCK: Application on board rolling stock (rail-tram-trolley vehicles). Electrical characteristics according to EN60077.

Available also the product series:

RAILWAYS, FIXED EQUIPMENT: Approved and conforming relays and products to RFI (FS Group) specification no. RFI DPRIM STF IFS TE 143 A

For the list of RFI approved and conforming products, consult dedicated catalog "RAILWAY SERIES – RFI APPROVED".

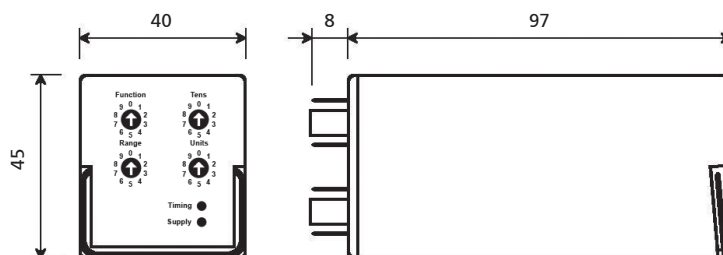
STATIONS: ENEL approved material meeting LV15/LV16 specifications.

For the list of ENEL approved and conforming products, consult the dedicated catalog "STATIONS SERIES – LV15-LV16-LV20".

(2) Other values on request.

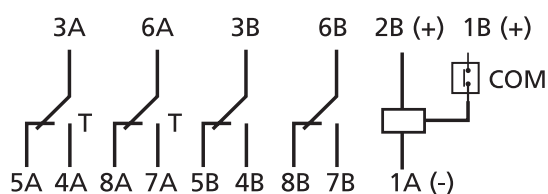
(3) Optional value. The positive mechanical keying is applied according to the manufacturer's model.

Dimensions and indicators

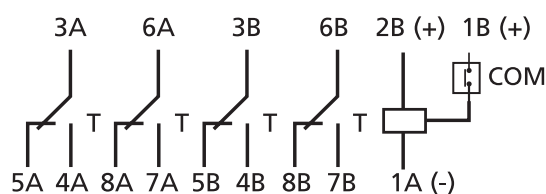


Timing = Green Led: time delay activated
Supply = Red Led: auxiliary power on

Wiring diagram



TMM2



TMM4

T = time delay contacts

Terminals 2B and 1A are allocated to the auxiliary power supply.

Terminal 1B is allocated to CONTROL. The negative of the control circuit is common with that of the auxiliary power supply.

Certain functions require an auxiliary power supply to guarantee operation of the time delay (terminal 2B).



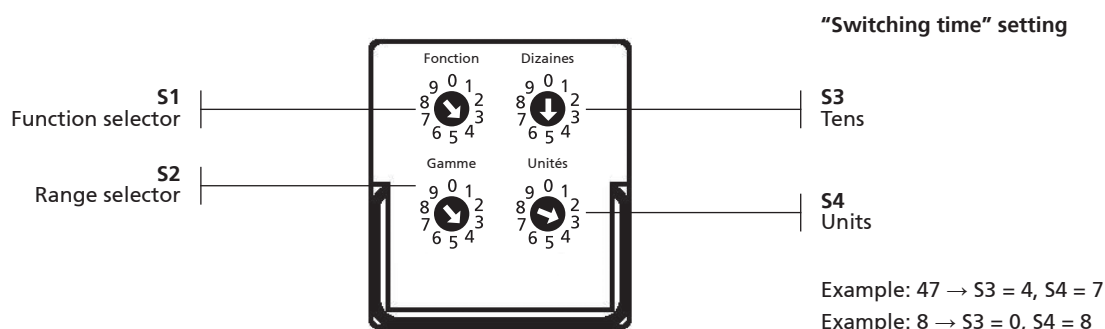
Time delay – Switching time setting

Controls setting function, range and time	4 rotary switches with 10 positions (0...9)
Time setting range	100 ms...99 h
Intermediate scales	10, from 9.9 seconds to 99 hours
Resolution of switching time setting	1% of intermediate scale
Accuracy, time delay (0.8...1.1 Un, t=20°C)	DC: $\pm 1\%$ of selected time or $\pm 10 \text{ ms}^{(1)}$ AC: $\pm 1\%$ of selected time; 0.1s...10s: $\pm 2\% \pm 20 \text{ ms}$
Accuracy, repeatability	DC: $\pm 0.5\%$ AC: $\pm 0.5\% + 20 \text{ ms}$
Reset	< 200 ms during time delay interval < 400ms
"COM" control signal	> 10 mS

(1) Whichever of the two values is higher.

The function and switching time are adjustable by means of 4 rotary-switch selectors located on the front of the relay, each having 10 positions, with which the user can select time delay settings between 100 ms and 99 hours.

The position of the arrow point on each rotary switch indicates the number selected. Adjustments are made by discrete steps, which means that no intermediate settings are possible.



Adjustment of switching time (except for function F6)

To adjust the switching time, the first step is to adjust the intermediate scale T(s), by selecting one of the 10 available scales using the S2 rotary switch. The values available are given in table 1.

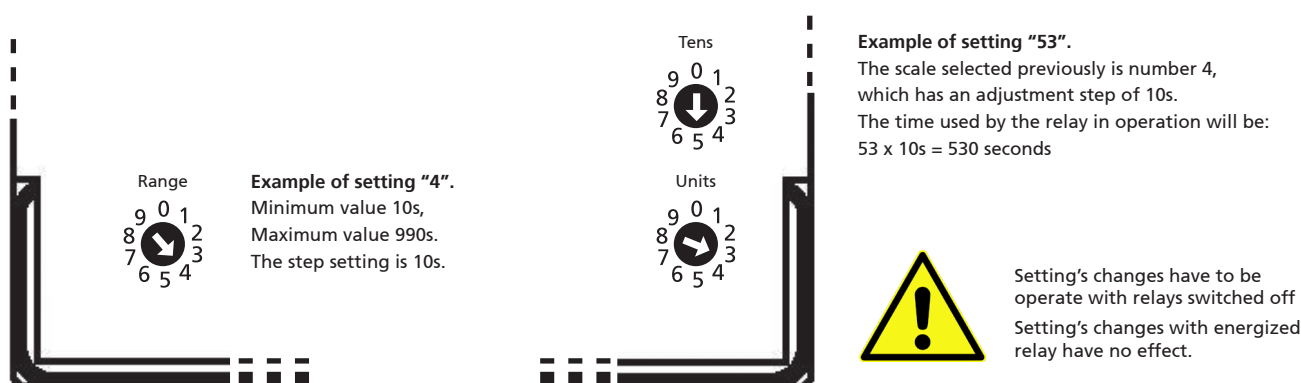
Scale	Minimum value	Maximum value	Step
0	0.1 s	9.9 s	100 ms
1	1 s	99 s	1 s
2	3 s	297 s	3 s
3	5 s	495 s	5 s
4	10 s	990 s	10 s

Scale	Minimum value	Maximum value	Step
5	1 min	99 min	1 min
6	3 min	297 min	3 min
7	5 min	495 min	5 min
8	10 min	990 min	10 min
9	1 h	99 h	1 h

Table 1 – Available scales

Next, the switching time is adjusted by means of rotary-switch selectors S3 and S4.

The combination of these two 10-position controls, located on the right, allows the selection of a number between 1 and 99. The number selected with the "Tens" arrow combined with the number selected with the "Units" arrow represents the multiplier of the step selected via the "Range" control. The resulting value gives the time used by the relay in operation.



Adjustment of switching time for function F5 – Asymmetric flash

Function F5 pilots an asymmetric flash. The "ON" time and the "OFF" time are adjustable independently

"ON" time (t) → selector S4

"OFF" time (T) → selector S4

In this instance, selector S3 and selector S4 are both calibrated in UNITS. Position "0" assumes the value of 10 integers.

Once the scale has been set by means of selector S2, selectors S3 and S4 are used to set the number that will provide the multiplier for the step of the selected scale.

Example: S2 = 1 → unit of time : seconds

S4 = 3 → t = 3 seconds

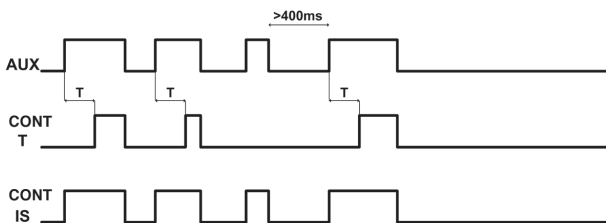
S3 = 0 → T = 10 seconds

Functions - selections and operating diagrams

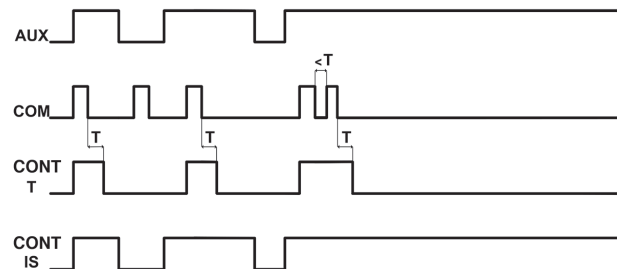
SELECTING THE FUNCTION

The function is selected by positioning the arrow of selector S1 so that the point is aligned with the number of the required function.

Function	Description
F0	Time delay on pick-up.
F1	Time delay on drop-out. Instantaneous contacts follow the status of the auxiliary power supply.
F2	Time delay on drop-out, instantaneous contacts on "CONTROL". Instantaneous contacts follow the status of the control signal.
F3	One-shot function.
F4	Flasher, symmetrical. The "ON" time and the "OFF" time are the same.
F5	Flasher, asymmetrical. The "ON" time and the "OFF" time are different, and adjustable independently.
F6	One-shot function on "CONTROL". The timing cycle starts on activation of the control signal.
F7	One-shot function with fixed pulse (3s), delayed at pick-up. Pulse delay adjustable.
F8	One-shot function, on "CONTROL", with fixed pulse (3s), delayed at pick-up. The timing cycle starts on activation of the control signal. Pulse delay adjustable.
F9	Step function

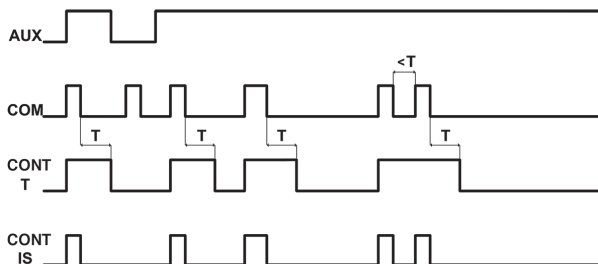


F0 – Time delay on pick-up.



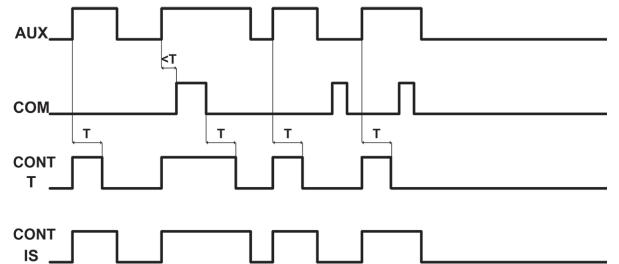
F1 – Time delay on drop-out, instantaneous contacts follow the status of the auxiliary power supply.

The instantaneous contacts follow the status of the auxiliary power supply (2B terminal).



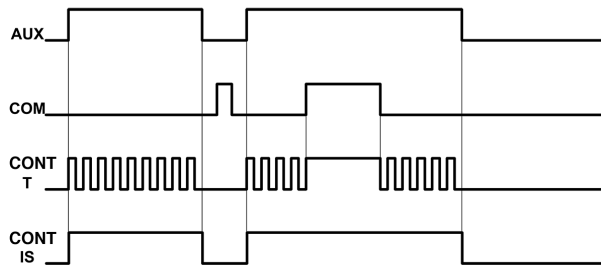
F2 – Time delay on drop-out.

The instantaneous contacts follow the status of the control signal ("COM", 1B terminal).



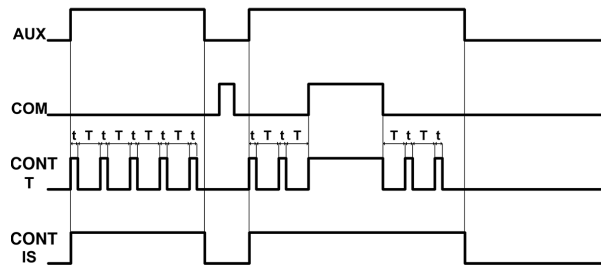
F3 – One-shot function.

The control signal ("COM", 1B terminal) resets the time "t", on drop-out.



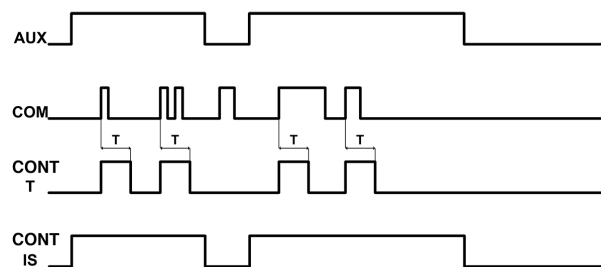
F4 – Flasher, symmetrical.

The control signal ("COM", 1B terminal) stops the flash.

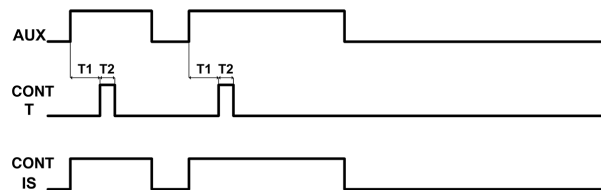


F5 – Flasher, asymmetrical.

The control signal ("COM", 1B terminal) stops the flash t and T are adjustable using the same unit of time.
Example: S2 = 1φ unit of time: seconds
S4 = 3φ t = 3 seconds
S3 = 0φ T = 10 seconds

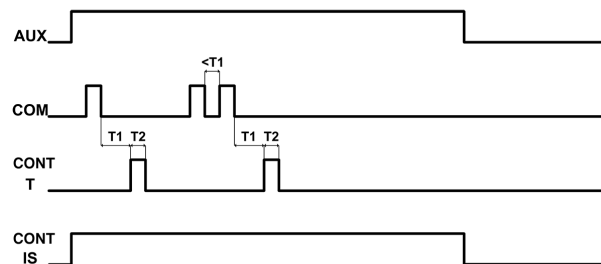


F6 – One-shot function on "CONTROL" (COM).



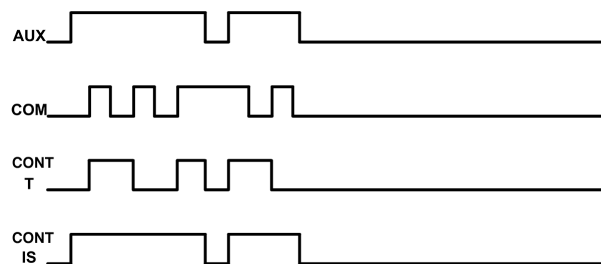
F7 – One-shot function with fixed pulse (3s), delayed at pick-up.

T1: adjustable by way of selector S3 / S4
T2 : fixed, 3 seconds



F8 – One-shot function, on "CONTROL", with fixed pulse (3s), delayed at pick-up.

T1: adjustable by way of selector S3 / S4
T2 : fixed, 3 seconds
Control signal ("COM", 1B terminal) starts time delay T1
Control signal ("COM", 1B terminal) restarts the time, if this appears during the time delay.



F9 - Step function

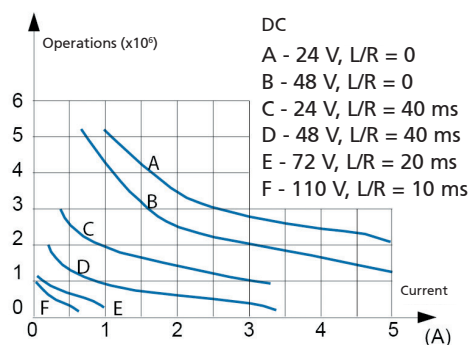
The S3 and S4 switches have no effect on the relay operation.

Applicable note for all operations diagrams:

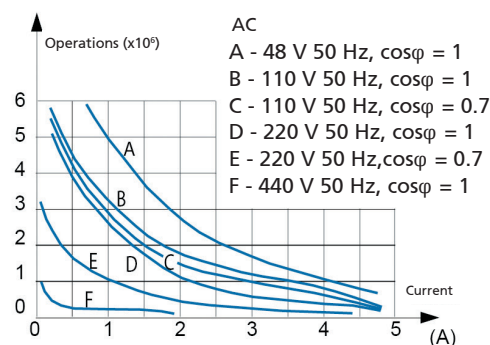
AUX: 2B - 1A terminals
COM: 1B terminal
CONT T: timed contacts
CONT I: instantaneous contacts

See "Wiring diagram" to identify the instantaneous and timed contacts terminals'.

Electrical life expectancy ⁽¹⁾



Some Examples of electrical life expectancy
12 Vdc - 10 A - Resistive: 10^5 operations
48 Vdc - 5 A - L/R 10 ms: 5×10^5 operations
80 Vdc - 5 A - Resistive: 5×10^5 operations
110 Vdc - 0,5 A - L/R 10 ms: 5×10^5 operations
110 Vdc - 1 A - L/R 0 ms: 10^5 operations



132 Vdc - 0,7 A - 132 Vdc - L/R 40 ms: 10^5 operations
220 Vdc - 0,2 A - L/R 10 ms: 10^5 operations
110 Vac - 5 A - $\cos\phi$ 0,7: 5×10^5 operations
220 Vac - 3 A - $\cos\phi$ 0,7: 5×10^5 operations
440 Vac - 0,2 A - Resistive: 5×10^5 operations

(1) Switching frequency 1,200 operations/hour, 50% cycle.

Sockets and retaining clips

Number of terminals (standard dimensions 5x0.8mm)	16	Retaining clip
For wall or rail mounting		
Spring clamp, wall or DIN H35 rail mounting	PAIR160	RT48
Screw, wall or DIN H35 rail mounting	48BIP20-I DIN	RT48
Screw, wall mounting	48BL	RT48
For flush mounting		
Spring clamp	PRIR160	RT48
Double faston (4.8 x 0.8 mm)	ADF2	RT48
Screw	43IL ⁽¹⁾	RT43
For mounting on PCB	65	RT43

(1) Insert the clip before fastening the socket on the panel.
For more details, see specifications of mounting accessories.

Mounting tips

The preferred mounting position is on the wall, with the relay positioned horizontally in the reading direction on the nameplate. For correct use of the relays, they should be spaced apart by at least 5 mm in the horizontal direction and 20 mm in the vertical direction. This is to allow correct upward dissipation of the heat generated by the coil. Set these distances according to the socket used. Distances can be reduced depending on the environmental application conditions and on the relay duty cycle.

For safe and secure operation, it is advisable to use retaining clips.

No special maintenance is required.

Condensation can form inside the relay when powered up and the outside ambient temperature is cold; this is quite normal and does not affect the operation of the relay. The plastic materials of the relay do not possess hygroscopic properties.