



RELAYS

MULTISCALE MONOSTABLE TIMER RELAYS WITH 4 CONTACTS

TM SERIES

USER SECTORS



Power generation



Nuclear



Power transmission



Rolling Stock



Fixed railway installations



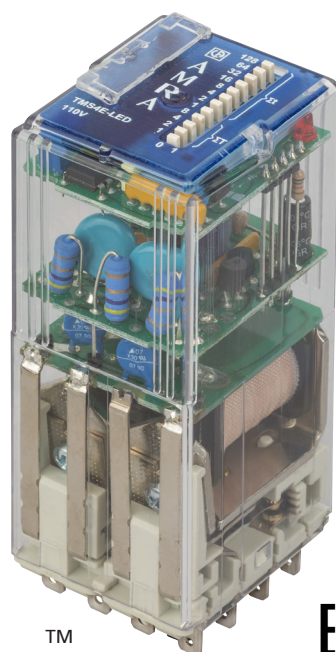
Shipbuilding



Petroleum industry



Heavy industry



TM

EAC

PRODUCT ADVANTAGES

- Plug-in relay with time delay on pick-up or on drop-out
- 4 time delay contacts or 2 time delay contacts + 2 instantaneous contacts
- Wide time setting range from 0.1s to 9 hours, great accuracy over the entire 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 variety of configurations and customizations
- Option for use in geothermal sites available
- Wide range of sockets
- Retaining clip for secure locking of relay on socket
- Transparent cover, pull-out handle
- Positive mechanical keying for relay and socket

DESCRIPTION

The **TM series** is a range of relays with electronic time delay on pick-up or drop-out, consisting of 8 models with 4 change-over contacts, from 5 to 10 A (nominal). They are obtained by assembling the electromechanical units of the POK or BIPOK series with a digital electronic circuit.

The electromechanical part features the **reliability and ruggedness** of relays belonging to the POK series, while the electronics offers high reliability thanks to the use of an electronic circuit requiring few components and to the careful choice of professional products.

With the same product it is possible to obtain switching times ranging from **0.1 second to over 9 hours**, with the greatest of accuracy over the entire setting range. This is thanks to the fact that the relay has 16 intermediate scales, freely selectable by the user.

Switching time is adjustable by means of two dipswitches, 4- and 8-bit respectively, located on the front of the relay. The 4-bit dipswitch serves for selecting the most suitable intermediate scale, while the 8-bit dipswitch is used for precision selection of the switching time.

On request, the models are available with fixed switching time to avoid modifications to the time setting.

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, control and signalling functions in electricity generating stations, electrical transformer stations, rail transport or in industries with continuous production processes (chemical industry, petroleum industry, rolling mills, cement factories, etc.). A specific treatment (P5GEO or P6GEO) combining coil tropicalization with gold-plated contacts allows the use of these items in geothermal electric power stations, as relays for signalling functions, for controlling intermediate devices and for all non-power circuits.

Above all, the excellent ability to withstand shock and vibration allow their use on rolling stock.

Models	Function		Nominal current		Number of contacts		Rolling stock application
	Pick-up	Drop-out	5 A	10 A	Time-delayed	Instantaneous	
TM2E	•		•		2	2	•
TM4E	•		•		4	-	•
TMS2E	•			•	2	2	•
TMS4E	•			•	4	-	•
TM2R		•	•		2	2	•
TM4R		•	•		4	-	•
TMS2R		•		•	2	2	•
TMS4R		•		•	4	-	•

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

Coil specifications	
Nominal voltages Un ⁽¹⁾	DC: 12-24-36-48-72-96-110-125-132-144-220 AC: 12-24-48-110-127-220-230
Max. consumption at Un (DC/AC)	4 W / 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⁾	DC: > 5% Un AC: > 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	TM2E - TM2R	TM4E - TM4R	TMS2E - TMS2R	TMS4E - TMS4R
Number and type	2 + 2 instantaneous CO, form C	4 CO, form C	2 + 2 instantaneous CO, form C	4 CO, form C
Current				
Nominal ⁽¹⁾	5 A		10 A	
Maximum peak (1 min) ⁽²⁾	10 A		20 A	
Maximum pulse (10 ms) ⁽²⁾	100 A		150 A	
EExample of electrical life expectancy ⁽³⁾	0.2 A – 110 Vdc – L/R = 40 ms: 10 ⁵ operations 0.7 A – 110 Vdc – L/R = 0 ms: 10 ⁵ operations		0.5 A – 110 Vdc – L/R = 40 ms: 10 ⁵ operations 1 A – 110 Vdc – L/R = 0 ms: 10 ⁵ operations	
Minimum load		500 mW (20 V, 20 mA)		
Standard contacts				
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		Ag / AgCu	
Operating time at Un (ms) ^{(5) (6)}		DC ⁽⁷⁾ – AC		
Pick-up (NO contact closing)		≤ 20 - ≤ 20		
Drop-out (NC contact closing)		≤ 15 - ≤ 20		

- On all contacts simultaneously, reduction of 30%.
- 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.
- For other values, see electrical life expectancy curves.
- Specifications of contacts on new relay
 - Plating material: **P4 GEO** : gold-nickel alloy (>6μ) **P8**: gold-cobalt alloy (>5μ), knurled contact
 - 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.
- Times for the instantaneous component of the relay.
- Unless specified otherwise, the operating time signifies until stabilization of the contact (including bounces). It should be added to the preset delay time.
- 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)
Withstand voltage at industrial frequency (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		DC: 20 x 10 ⁶	AC: 10 x 10 ⁶ operations
Maximum switching rate	Mechanical life expectancy	3,600 operations / hour	
Degree of protection (with relay mounted)		IP40	
Dimensions (mm) ⁽¹⁾		40 x 50 x 97	
Masse (g)		~ 220	

(1) Excluding output terminals



Environmental specifications

Operating temperature	Standard	-25° to +55°C
	Version for railway, rolling stock	-25° to +70°C
Storage and shipping temperature		-40° to +85°C
Relative humidity		Standard: 75% RH Tropicalized: 95% RH
Resistance to vibrations		5g - 10 to 55 Hz - 1 min
Resistance to shock		20g – 11 ms
Fire behavior		V0



Standards and reference values

EN 61810-1, EN 61810-2, EN 61810-7	Electromechanical elementary relays Timer relays Fire behavior Electromagnetic compatibility Degree of protection provided by enclosures
EN 61812-1	
EN 60695-2-10	
EN 61000	
EN 60529	

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 items of technical data are referred to ambient temperature 23 °C, atmospheric pressure 96kPa and 50% humidity.
Tolerance for coil resistance, nominal electrical input and nominal power is ±7%.



Railways, rolling stock - Standards

EN 60077	Electric equipment for rolling stock. General service conditions and general rules Electronic equipment used on rolling stock Rolling stock equipment. Shock and vibration tests, Cat 1 Class B Fire behavior, Cat E10, Requirement R26, V0 Fire behavior Safety of railway rolling stock - EAC certification
EN 50155	
EN 61373	
EN 45545-2	
ASTM E162, E662	
CU TR 001/2011	



Railways, rolling stock – Special operating ranges ⁽¹⁾

Nominal voltage	Minimum pick-up voltage	Maximum operating voltage	Order symbol ⁽¹⁾
24 Vdc	18	33	Z01
24 Vdc	16	32	Z02
24 Vdc	16.8	32	Z03
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 the coil with epoxy resin for use with 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 acid atmospheres (typical of geothermal power stations) or saline atmospheres.
P4GEO	Gold plating of contacts with gold-nickel alloy, thickness $\geq 6\mu$. 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	P4GEO gold-plating of contacts + P2 coil tropicalization.
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 $\geq 5\mu$, knurled fixed contact. This finish allows further improvement of the gold-plated contact performance compared to the treatment P4GEO.
LED	LED indicator showing presence of power supply, wired in parallel with the coil
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.
LOW TEMPERATURE	Minimum operating temperature -50 °C, only for rolling stock version (option "L").



TM Ordering scheme

Product code	Application ⁽¹⁾	Configuration A	Configuration B	Label	Type of power supply	Nominal voltage (V) ⁽²⁾	Keying position ⁽³⁾ / options
TM2E TM4E TMS2E TMS4E TM2R TM4R TMS2R TMS4R	E: Energy Railway Fixed Equipment R: Railway Rolling Stock	1: Standard 2: Diode // 3: Varistor 4: Led 5: Diode // + Led 6: Varistor + Led 7: Transil 8: Transil + Led	0 : Standard 2: P2 4: P4 GEO 5: P5 GEO 6: P6 GEO 7: P7 8: P8	F	C: Vdc A: Vac 50 Hz H: Vac 60 Hz	012 - 024 - 036 048 - 072 - 096 100 - 110 - 125 127 - 132 - 144 220 - 230	XXX L = low temperature

Example

TMS2R	E	4	2	F	A	230	
TMS2RE42F-A230 - TMS2R relay, ENERGY series, nominal voltage 230 Vac, provided with LED, with P2 finish (tropicalized coil)							
TM4R	R	1	8	F	C	024	L
TM4RR18F-C024 - TM4R relay, ROLLING STOCK series, nominal voltage 24 Vdc, with P8 finish (gold-plated contacts) and option "L" (low temp.)							

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

Suitable on energy production, transport and distribution plants, railways fixed equipment, petrochemical 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".

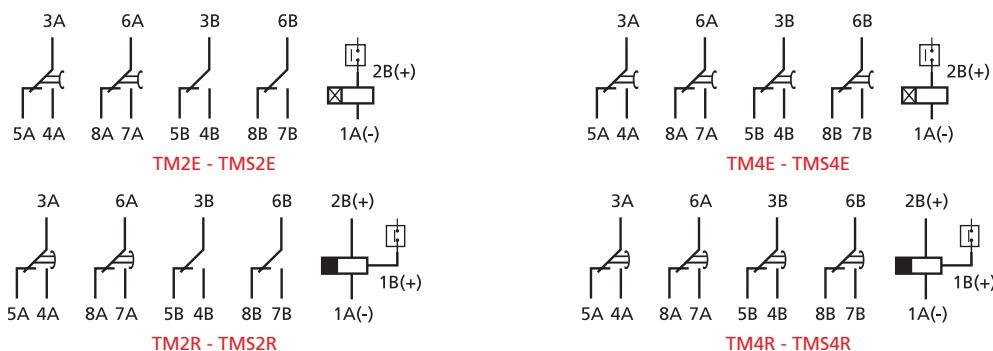
STATIONS: ENEL approved material meeting LV15/LV16 specifications.

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

(2) Other values on request.

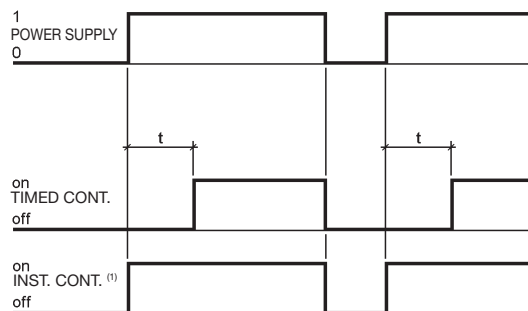
(3) Optional value. The positive mechanical keying is applied according to the manufacturer's model.

Wiring diagram

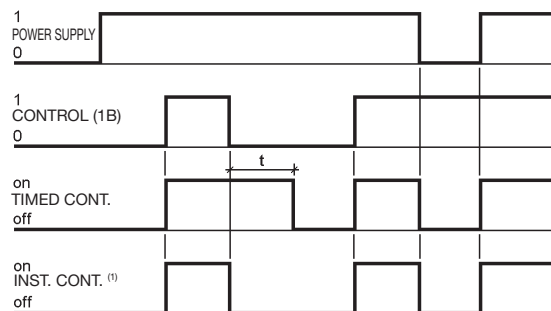


Relays with time delay on drop-out require an auxiliary power supply to ensure correct timing (terminal 2B)

Functional diagram



Time-delay on pick-up (version 2E, 4E)



Time-delay on drop-out (version 2R, 4R)

⁽¹⁾ Instantaneous contacts are present only on versions "2E" and "2R"



Time delay – Switching time setting

Time setting	By means of DIP switches
Time setting range	100 ms...32,768 s
Intermediate scale	16, from 1 second to 32,768 seconds
Resolution of switching time setting	1/256 of the selected scale
Accuracy, time-delay ⁽¹⁾	± 1% of the switching time ± 0.5% of the scale
Accuracy, repeatability	DC : ± 0.5% AC : ± 0.5% + 20 ms
Reset	< 100ms in time-delay phase < 400ms
Insensitivity to voltage drops	< 100 ms

(1) Additional error for drop-out versions: 100 ms

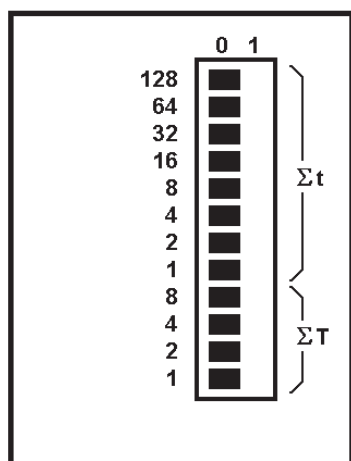
The switching time is adjustable via the dipswitches (4- and 8-bit respectively) located on the front of the relay, through which it is possible to obtain time delays from 100 ms to 32,768 seconds (about 9 hours). To adjust the switching time, the first step is to adjust the intermediate scale T(s), by selecting one of the 16 available scales using the 4-bit dipswitch. The values available are given in table 1.

The value of the T(s) scale should be the next highest numerically than the value of the required switching time.

E.g. Switching time: 3600 seconds → intermediate scale to set: 4096 seconds

The T(s) scale is set by identifying the switches that add up to the ΣT value indicated in table 1, and positioning them at "1".

Next, proceed to set the switching time by means of the 8-bit dipswitch.



Σt
Switching time
dipswitches
(8bit)

Σ
Intermediate scale
dipswitches
(4 bit)

T(s)	ΣT	Switch reference			
		8	4	2	1
		Switch position			
1	0	0	0	0	0
2	1	0	0	0	1
4	2	0	0	1	0
8	3	0	0	1	1
16	4	0	1	0	0
32	5	0	1	0	1
64	6	0	1	1	0
128	7	0	1	1	1
256	8	1	0	0	0
512	9	1	0	0	1
1 024	10	1	0	1	0
2 048	11	1	0	1	1
4 096	12	1	1	0	0
8 192	13	1	1	0	1
16 384	14	1	1	1	0
32 768	15	1	1	1	1

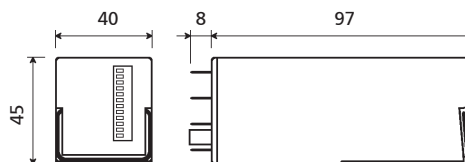
Table 1

$$\Sigma t = \frac{t \times 256}{T} \text{ where } t(s) : \text{required switching time } T(s) : \text{full scale time set previously}$$

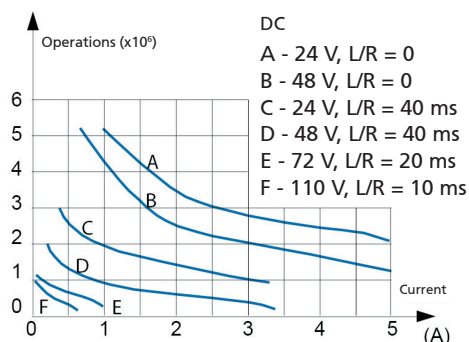
Example: Relay with time delay 22sec. and full scale time 32sec.

For the full scale time of 32 s, select value 5 in the ΣT column (see table), then identify the switches corresponding to 4 and 1 (4+1=5) and position them at "1". For the delay time of 22 s, set an Σt value of 176 (i.e. $22 \times 256 / 32$), then identify the switches corresponding to 128, 32 and 16 (128+32+16=176) and position them at "1".

Dimensions

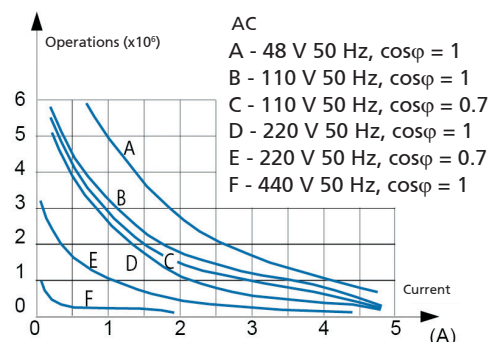


Electrical life expectancy ⁽¹⁾



Examples of electrical life expectancy

48 Vdc - 5 A - L/R 10 ms: 5 x 10⁵ operations
80 Vdc - 5 A - Resistive: 5 x 10⁵ operations
110 Vdc - 0.5 A - L/R = 10 ms: 5 x 10⁵ operations



220 Vdc - 0.2 A - L/R = 10 ms: 10⁵ operations
110 Vac - 5 A - Cosφ = 0.7: 5 x 10⁵ operations
220 Vac - 3 A - Cosφ = 0.7: 5 x 10⁵ operations
440 Vac - 0.2 A - Resistive: 5 x 10⁵ operations

(1) Switching frequency 1200 operations/hour, cycle 50%.

Sockets	
Number of terminals	16
For wall or rail mounting	
Spring clamp, wall or DIN H35 rail mounting	PAIR160
Screw, wall or DIN H35 rail mounting	48BIP20-I DIN
Screw, wall mounting	48BL
Double faston, wall mounting	48L
For flush mounting	
Double faston (4.8 x 0.8 mm)	ADF2
Screw	43IL
For mounting on PCB	
	65

For more details, see specifications of mounting accessories.

Retaining clips – correspondence with sockets

Number of clips per relay	1, 2 for use on rolling stock
SOCKET MODEL	CLIP MODEL
For wall or rail mounting	
PAIR160, 48BIP20-I DIN, 48BL, 48L	RT48
For flush mounting	
ADF2	RT48
43IL ⁽¹⁾	RT43
For mounting on PCB	
65	RT43

(1) Insert the clip before fastening the socket on the panel.

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.