

6 - Protection components

Relays

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Applications

- Standard motor protection
- Line protection



Protection

- Motor overload
Stalling
Phase failure

Communication

—

Associated with contactor type

- LC1 K, LP1 K
- LC1 D
- LC1 F

Motor current (In)





- 0.11...16 A
- 0.1...150 A
- 30...630 A

Relay type references

- LR2 K
- LR D
- LR9 F

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Machine protection		Standard motor protection		Motor protection and control
Specific motor protection		Protection of slip ring motors and of circuits without current peaks	Protection of resistors, bearings, capacitors	Protection
				
Overtorque Mechanical shocks Locked rotor Phase failure		Strong overcurrent Stalling	Frequent starting Harsh environments	Thermal overload Phase imbalance and phase failure Stalling Reversal of phase rotation Underload and protracted starting time Earth fault Too low power factor, $\cos \varphi$
—				Yes
All contactors				
0.3...38 A	0.3...60 A	0.7...630 A	Unlimited	1...5 A
LR97 D	LT47	RM1 XA	LT3 S	LT6
6/38		6/69 and 6/70	6/64	6/48 and 6/49

Protection components

Motor protection

Operating conditions

There are many possible causes of electric motor failure. One of the most common, and which is often accidental, is the utilisation of motors beyond the operating limits defined by the manufacturer or in abnormal ambient conditions.

A statistical survey carried out in Britain, covering 9000 incidents of motor failure, gave the following results:

Overloads	30 %
Pollution (example: corrosive atmosphere)	19 %
Phase failure	14 %
Bearing failure	13 %
Ageing (example: ambient temperature too high)	10 %
Rotor faults	5 %
Miscellaneous	9 %

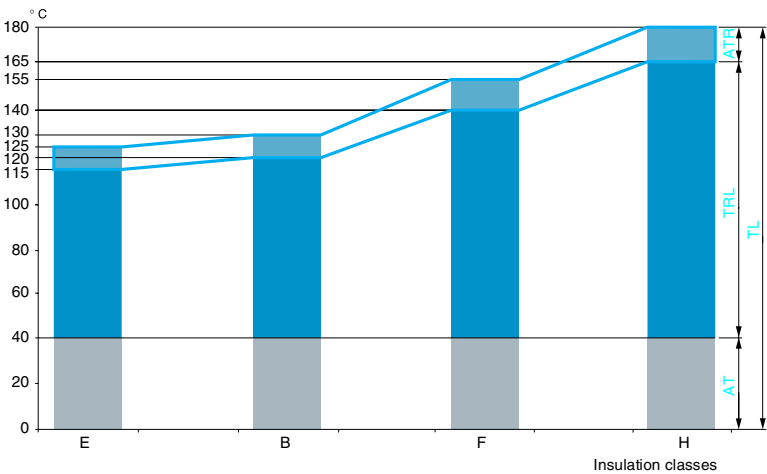
These faults are related to motors with a power rating of 37 kW or more.

An examination of the above results shows that, in more than 50 % of cases, the fault is due to the effects of heating.

Leaving aside the replacement of wearing parts, such as bearings, slip rings, brushes, etc., the life of a rotating machine is linked to that of its insulation. Provided that the temperature rise limit is not exceeded, the life expectancy of insulating materials is extremely long. It is decreased by approximately one half for an excess temperature rise of 10 °C.

The operating temperature limit **TL** of an insulating material depends on the type of material and is the sum of the ambient air temperature **AT** (cooling air), the temperature rise limit **TRL** and an additional temperature rise value **ATR** considered necessary because the measurement of winding resistance variation does not determine the temperature of the hottest part of the motor winding, but only gives an average value for temperature rise.

The diagram below defines the standardised limits for different classes of insulation. In all cases, the normal ambient cooling air temperature is fixed at 40 °C.



Protection components

Motor protection

The rated power of a motor corresponds to its temperature rise limit for an ambient temperature of 40 °C. The standard temperature rise limits for the different parts of a machine are given in the following table, which is an extract from publication IEC 60034-1.

Temperature rise limit in °C			
	Insulation class		
	B	F	H
Insulated winding (measurement by resistance)	80	100	125
Commutators and slip-rings	80	90 (1)	100 (1)
Bearings	60	60 (2)	60 (2)

When a motor is used at an ambient air temperature other than the normal value, its temperature rise limit should be modified in order to maintain the same maximum temperature limit. The result is that the motor operational power is no longer the same as its rated power.

Also, the altitude of the installation, if this is above 1000 m, affects the cooling and increases the temperature rise.

The following table gives the ratio between operational power and rated power, according to the operating conditions, for a given ambient temperature. It corresponds to insulation class B.

Operational power / Rated power in watts							
Altitude m	Ambient temperature						
	30 °C	35 °C	40 °C	45 °C	50 °C	55 °C	60 °C
1000	1.07	1.04	1.00	0.96	0.92	0.87	0.82
1500	1.04	1.01	0.97	0.93	0.89	0.84	0.79
2000	1.01	0.98	0.94	0.90	0.86	0.82	0.77
2500	0.97	0.95	0.91	0.87	0.84	0.79	0.75
3000	0.93	0.91	0.87	0.84	0.80	0.76	0.71
3500	0.89	0.86	0.83	0.80	0.76	0.72	0.68
4000	0.83	0.81	0.78	0.75	0.72	0.68	0.64

The values shown in the above table are for guidance only. In effect, the derating of a motor depends on its size, insulation class, method of construction (self-ventilated or forced ventilation, degree of protection IP 23, IP 44, etc.), and varies according to the manufacturer.

Also, in addition to the normal ambient conditions, the rated power of a motor is defined by the manufacturer for continuous duty S1. This covers continuous operation of sufficient duration to enable the motor to reach a steady temperature. It is this value of rated power that is normally shown on the motor plate.

There are other standardised types of duty, such as temporary duty S2, or intermittent periodic duty type S3, S4 and S5, for which the motor manufacturer defines an operational power appropriate to each and different from the rated power.

(1) For temperature rise limits of 90 °C and 100 °C the brushes must be selected with the agreement of the motor manufacturer.

(2) These limit values may be exceeded, depending on the quality of the grease used and the applied loads.

Protection components

Motor protection

Selection of thermal protection

To optimise the life of a motor, it is important to select the appropriate thermal protection which will prevent operation under abnormal heating conditions, whilst ensuring maximum continuity in the operation of the driven machine or associated plant by avoiding unnecessary stoppages.

It is essential to know the real operating conditions:

- ambient temperature,
- operating altitude,
- type of standard duty,

in order to determine the operational values for the motor (power, current) and to be able to select efficient thermal protection.

These operational values are given by the motor manufacturer.

Various types of thermal protection devices are available:

- thermal overload relays or thermal-magnetic motor circuit-breakers,
- thermistor protection relays, with PTC thermistor probes ⁽¹⁾
- multifunction relays.

Protection by thermal overload relay

A conventional thermal overload relay protects the motor in the following two cases:

- overload, by monitoring the current drawn by each phase,
- phase imbalance or failure, by its differential mechanism.

It therefore covers 44% of the cases of motor failure. This type of protection relay is widely used, is extremely reliable and is a relatively low cost device. It is particularly recommended if there is a risk of rotor locking.

Nevertheless, it has the disadvantage of not taking into account, with sufficient accuracy, the thermal state of the motor.

The operating principle of this type of device is, in fact, based on the bending of bimetal strips caused by the current drawn by the motor. As the thermal inertias of the overload relay and motor are different, in some cases it may be possible to restart the motor following an overload trip even though its temperature is still too high.

Protection by instantaneous electronic over current relays

LR97 D and LT47 electronic over current relays have been developed to satisfy machine protection requirements.

By monitoring the current through the current transformers with which they are equipped, they provide protection against:

- overtorque or mechanical shock,
- locked rotor (mechanical locking under steady state conditions),
- phase failure.

These relays are particularly recommended for providing mechanical protection on machines with:

- high resistive torque,
- high inertia,
- and with strong probability of locking under steady state conditions.

They do not incorporate a thermal overload memory and can therefore be used to provide motor protection in severe duty applications, such as:

- long starting times,
- frequent starting.

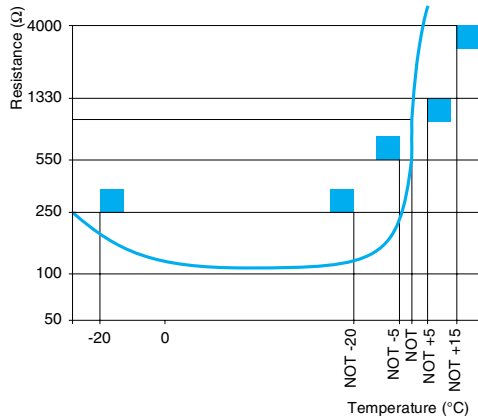
These relays have definite time characteristics: current threshold and time based function

Because of their two separate time settings "D-Time" (starting time) and "O-Time" (trip time during steady state), these over current relays can be combined with the motor-starter function.

⁽¹⁾ PTC: Positive Temperature Coefficient

Protection components

Motor protection



Markings complied with by universal probes "Mark A" (standard EC 60034-11-1A)

Protection by PTC thermistor relay

Better monitoring of the internal motor temperature can be provided by PTC thermistor probes, embedded in the motor windings during manufacture, associated with a thermistor protection relay (type LT3 S).

PTC probes are resistors with a positive temperature coefficient. Their resistance value increases very rapidly when their temperature reaches the Nominal Operating Temperature threshold, indicated by NOT on the curve opposite.

Their small size means that they have a low thermal inertia and can rapidly follow the temperature variations of their surroundings.

This is the only solution for motor protection in applications involving severe starting/stopping (duties S3, S4, S5) and, likewise, for applications where the motor could be inadvertently overcooled.

Problems other than those due to thermal effect can also arise: earth fault, abnormal overheating of bearings, etc.

More comprehensive protection can be obtained:

- either by associating several types of protection device (example: thermal overload relay + thermistor protection relay + earth fault relay),
- or by using a multifunction protection relay type LT6.

Protection relays

Relay type	Thermal overload (1) LR2 K, LRD, LR9 F	Over current LR97D	Over current LT47	For use with PTC probes LT3	Multifunction LT6
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Causes of overheating

Slight overload					
Locked rotor					
Underload					
Supply phase failure					
Ventilation fault					With PTC probes
Abnormal rise in ambient temperature					With PTC probes
Shaft bearing seizure					With PTC probes
Insulation fault					
Protracted starting time					
Severe duty					With PTC probes

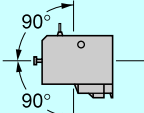
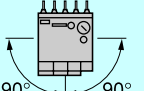
Ideally suited

Possible solution

Not suitable (no protection)

(1) Or motor circuit-breaker type GV2 ME, for example.

Environment

Conforming to standards			IEC 60947, NF C 63-650, VDE 0660, BS 4941		
Product certifications			UL, CSA		
Protective treatment	Conforming to IEC 60068 (DIN 50016)		"TC" (Klimafest, Climateproof)		
Degree of protection	Conforming to VDE 0106		Protection against direct finger contact		
Ambient air temperature around the device	Storage	°C	- 40...+ 70		
	For normal operation (IEC 60947)	°C	- 20...+ 55 (without derating)		
	Operating limit	°C	- 30...+ 60 (with derating) (1)		
Maximum operating altitude	Without derating	m	2000		
Operating positions			Vertical axis  Without derating	Horizontal axis  With derating (1)	
Flame resistance	Conforming to UL 94		Self-extinguishing material V1		
	Conforming to NF F 16-101 and 16-102		Conforming to requirement 2		
Shock resistance, hot state (1/2 sine wave, 11 ms)	Conforming to IEC 60068, N/C contact		10 gn		
	Conforming to IEC 60068, N/O contact		10 gn		
Vibration resistance, hot state 5 to 300 Hz	Conforming to IEC 60068, N/C contact		2 gn		
	Conforming to IEC 60068, N/O contact		2 gn		
Safe separation of circuits	Conforming to VDE 0106 and IEC 60536		VLSV (2), up to 400 V		
Cabling Screw clamp terminals	Solid cable	mm ²	Minimum	Maximum	Maximum to IEC 60947
	Flexible cable without cable end	mm ²	1 x 1.5	2 x 4	1 x 4 + 1 x 2.5
	Flexible cable with cable end	mm ²	1 x 0.75	2 x 4	2 x 2.5
Tightening torque	Philips head n° 2 - Ø 6	N.m	0.8	1 x 1.5 + 1 x 2.5	1 x 1.5 + 1 x 2.5
Mounting			Directly under the contactor or reversing contactor		
Connections			Made automatically when mounted under the contactor, as follows : ■ contactor terminal A2 connected to overload relay terminal 96 on all products, ■ contactor terminal 14 connected to overload relay terminal 95 on products with 3 P + N/O. When using 3 P + N/C, or 4 P contactors, or the N/O auxiliary contact marked 13-14, at a voltage other than the coil voltage, break off the link marked 14.		

Auxiliary contact characteristics

Number of contacts			1 N/C + 1 N/O						
Conventional thermal current		A	6						
Short-circuit protection	Conforming to IEC 60947, VDE 0660. gG fuse or circuit-breaker GB2 CB●●	A	6 max.						
Maximum power of the controlled contactor coils (sealed) (Occasional operating cycles of contact 95-96)	a.c.	V	24	48	110	220/230	400	415/440	600/690
		VA	100	200	400	600	600	600	600
	d.c.	V	24	48	110	220	250	—	—
		W	100	100	50	45	35	—	—
Maximum operational voltage	a.c., category AC-15	V	690						
	d.c., category DC-13	V	250						

(1) Please consult your Regional Sales Office.

(2) Very low safety voltage.

k thermal overload relays,
adjustable from 0.11 to 16 A

Electrical characteristics of the power circuit

Rated operational voltage (Ue)	Up to	V	690
Rated insulation voltage (Ui)	Conforming to BS 4941	V	690
	Conforming to IEC 60947	V	690
	Conforming to VDE 0110 group C	V	750
	Conforming to CSA C 22-2 n° 14	V	600
Rated impulse withstand voltage (Uimp)		kV	6
Frequency limits of the operational current		Hz	Up to 400
Power dissipated per pole		W	2

Operating characteristics

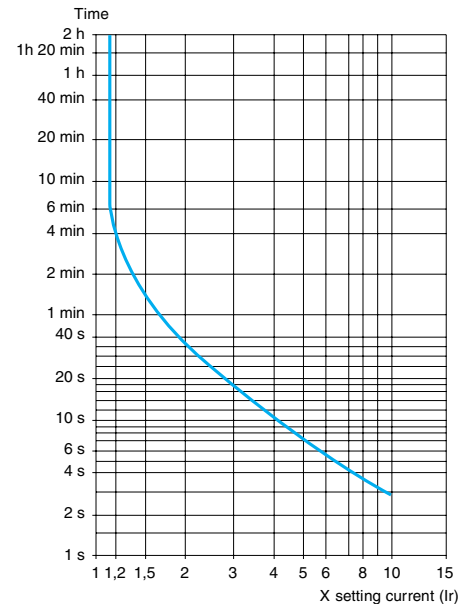
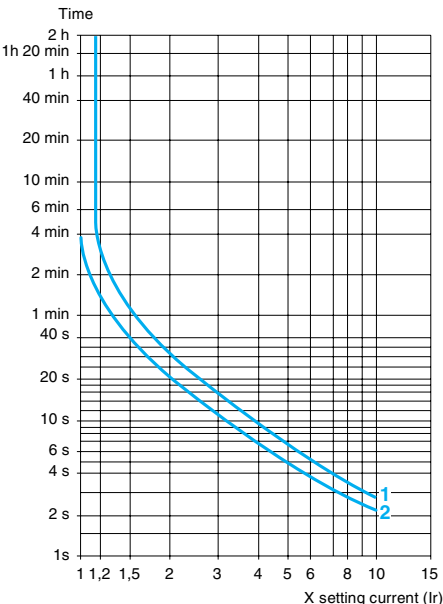
Sensitivity to phase failure	Conforming to IEC 60947		Yes
Reset	Manual or automatic		Selected by means of a lockable and sealable switch on the front of the relay
Signalling	On front of relay		Trip indicator
Reset-Stop function			Pressing the Reset-Stop button : - actuates the N/C contact - has no effect on the N/O contact
Test function	By pushbutton		Pressing the Test button enables : - checking of the control circuit wiring - simulation of overload tripping (actuation of both N/C and N/O contacts, and of the trip indicator)
Short-circuit protection and coordination			See pages 1/18 and 1/28

Tripping curves

Average operating time related to multiples of the current setting (Class 10 A)

Balanced 3-phase operation, from cold state

Balanced operation with 2 phases only, from cold state



1 Setting : at lower end of scale

2 Setting : at upper end of scale

Protection components

k thermal overload relays,
adjustable from 0.11 to 16 A

3-pole relays with screw clamp terminals

These overload relays are designed for the protection of motors. They are compensated and phase failure sensitive. Resetting can either be manual or automatic.

Direct mounting: under the contactor for versions with screw clamp terminals only; pre-wired terminals, see pages 6/8 and 6/11.

Separate mounting: using terminal block **LA7 K0064** (see below).

On the front face of the overload relay:

- selection of reset mode: Manual (marked H) or Automatic (marked A),
- red pushbutton: Trip Test function,
- blue pushbutton: Stop and manual Reset,
- yellow trip flag indicator: overload relay tripped.

Protection by magnetic circuit-breaker type GV2 LE, see pages 1/18 and 1/28.

Class 10 A (the standard specifies a tripping time of between 2 and 10 seconds at 7.2 In)

Relay setting range	Fuses to be used with selected relay			Reference	Weight
	Maximum rating Type				
	aM	gG	BS88		
A	A	A	A		kg
0.11...0.16	0.25	0.5	–	LR2 K0301	0.145
0.16...0.23	0.25	0.5	–	LR2 K0302	0.145
0.23...0.36	0.5	1	–	LR2 K0303	0.145
0.36...0.54	1	1.6	–	LR2 K0304	0.145
0.54...0.8	1	2	–	LR2 K0305	0.145
0.8...1.2	2	4	6	LR2 K0306	0.145
1.2...1.8	2	6	6	LR2 K0307	0.145
1.8...2.6	4	8	10	LR2 K0308	0.145
2.6...3.7	4	10	16	LR2 K0310	0.145
3.7...5.5	6	16	16	LR2 K0312	0.145
5.5...8	8	20	20	LR2 K0314	0.145
8...11.5	10	25	20	LR2 K0316	0.145
10...14	16	32	25	LR2 K0321	0.145
12...16	20	40	32	LR2 K0322	0.145

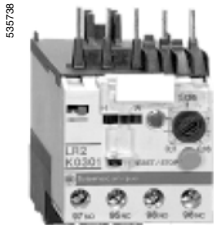
Overload relays for unbalanced loads

Class 10 A: To order, replace the prefix **LR2** by **LR7** in the references selected from above (only applicable to overload relays **LR2 K0305** to **LR2 K0322**).

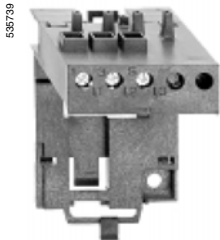
Example: **LR7 K0308**.

Accessory

Description	Type of connection	Reference	Weight kg
Terminal block for separate clip-on mounting of the overload relay on 35 mm rail	Screw clamp	LA7 K0064	0.100



LR2 K0301



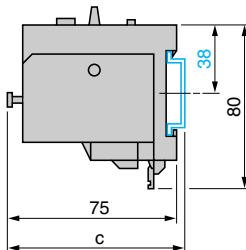
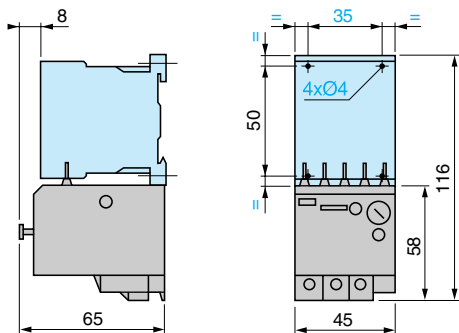
LA7 K0064

Dimensions, mounting

LR2 K

Direct mounting beneath the contactor

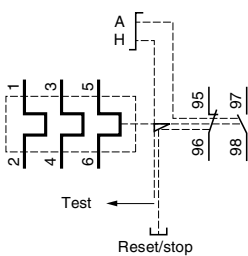
Separate mounting with terminal block LA7 K0064 on 35 mm rail
(AM1 DP200 or AM1 DE200)



AM1	c
DP200	78.5
DE200	86

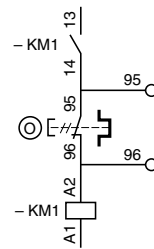
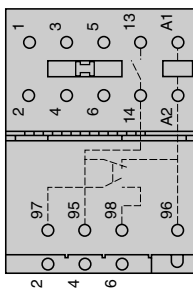
Schemes

LR2 K

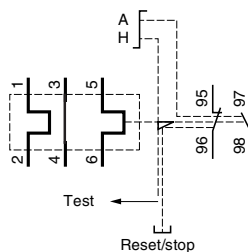


LR2 K + LC• K

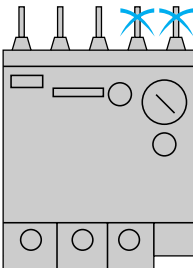
Pre-wiring scheme



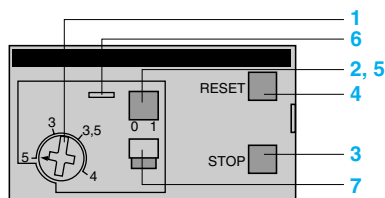
LR7 K



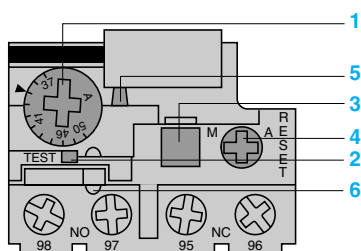
Note : If pre-wiring is not required, break off the 2 links located on the thermal overload relay.



Description



LRD 01...35



LRD 3322...4369, LR2 D

Model d 3-pole thermal overload relays are designed to protect a.c. circuits and motors against overloads, phase failure, long starting times and prolonged stalling of the motor.

- 1 Adjustment dial I_r .
- 2 Test button.
Operation of the Test button allows:
 - checking of control circuit wiring,
 - simulation of relay tripping (actuates both the N/O and N/C contacts).
- 3 Stop button. Actuates the N/C contact; does not affect the N/O contact.
- 4 Reset button.
- 5 Trip indicator.
- 6 Setting locked by sealing the cover.
- 7 Selector for manual or automatic reset. Relays LRD 01 to 35 are supplied with the selector in the manual position, protected by a cover. Deliberate action is required to move it to the automatic position.

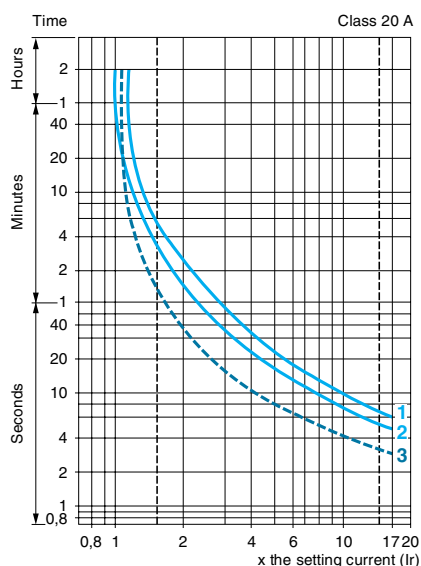
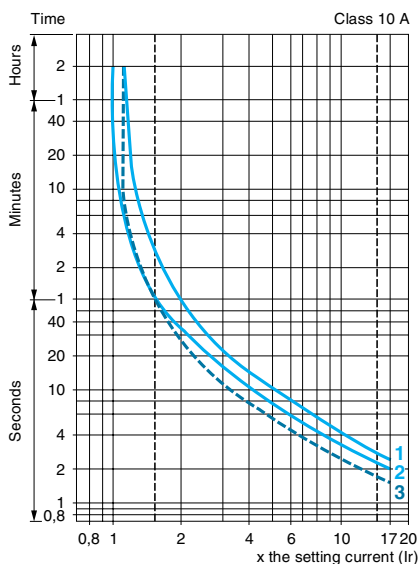
Environment

Conforming to standards			IEC 60947-1, IEC 60947-4-1, NF C 63-650 VDE 0660, BS 4941
Product certifications			CSA, UL, Sichere Trennung, PTB except LAD 4: UL, CSA.
Degree of protection	Conforming to VDE 0106		Protection against direct finger contact IP 2X
Protective treatment	Conforming to IEC 60068		"TH"
Ambient air temperature around the device	Storage	°C	- 60...+ 70
	Normal operation, without derating (IEC 60947-4-1)	°C	- 20...+ 60
	Minimum and maximum operating temperatures (with derating)	°C	- 40...+ 70
Operating positions without derating	In relation to normal vertical mounting plane		Any position
Shock resistance	Permissible acceleration conforming to IEC 60068-2-7		15 gn - 11 ms
Vibration resistance	Permissible acceleration conforming to IEC 60068-2-6		6 gn
Dielectric strength at 50 Hz	Conforming to IEC 60255-5	kV	6
Surge withstand	Conforming to IEC 60801-5	kV	6

Auxiliary contact characteristics

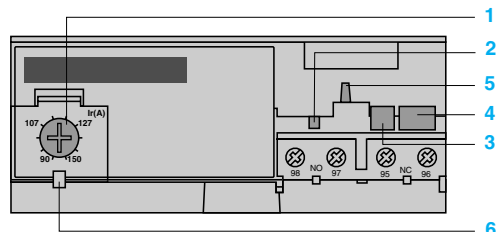
Conventional thermal current		A	5					
Maximum sealed current consumption of the operating coils of controlled contactors (Occasional operating cycles of contact 95-96)	a.c. supply	V	24	48	110	220	380	600
		VA	100	200	400	600	600	600
	d.c. supply	V	24	48	110	220	440	—
		W	100	100	50	45	25	—
Short-circuit protection	By gG, BS fuses. Maximum rating or by GB2 circuit-breaker	A	5					
Connection to screw clamp terminals (Min/max c.s.a.)								
Flexible cable without cable end	1 or 2 conductors	mm²	1/2.5					
Flexible cable with cable end	1 or 2 conductors	mm²	1/2.5					
Solid cable without cable end	1 or 2 conductors	mm²	1/2.5					
Tightening torque		N.m	1.7					
Connection to spring terminals (Min/max c.s.a.)								
Flexible cable without cable end	1 or 2 conductors	mm²	1/2.5					
Flexible cable with cable end	1 or 2 conductors	mm²	1/2.5					

Relay type		LRD 01 ...16, LR3 D01 ...D16	LR D15●●	LRD 21 ...35, LR3 D21 ...D35	LRD 3322 ...33696 LR3 D3322 ...D33696	LR2 D35●●	LRD 4365 ...4369
Electrical characteristics of power circuit							
Tripping class	Conforming to UL 508, IEC 60947-4-1	10 A	20	10 A	10 A	20	10 A
Rated insulation voltage (Ui)	Conforming to IEC 60947-4-1	V	690	690	1000		1000
	Conforming to UL, CSA	V	600	600	600		600 except LRD 4369
Rated impulse withstand voltage (Uimp)		kV	6	6	6		6
Frequency limits	Of the operating current	Hz	0...400	0...400	0...400		0...400
Setting range	Depending on model	A	0.1...13	12...38	17...104		80...140
Connection to screw clamp terminals (Min/max c.s.a.)							
Flexible cable without cable end	1 conductor	mm ²	1.5/10	1.5/10	4/35		4/50
Flexible cable with cable end	1 conductor	mm ²	1/4	1/6 except LRD 21 : 1/4	4/35		4/35
Solid cable without cable end	1 conductor	mm ²	1/6	1.5/10 except LRD 21 : 1/6	4/35		4/50
Tightening torque		N.m	1.7	1.85	2.5	9	9
Connection to spring terminals (Min/max c.s.a.)							
Flexible cable without cable end	1 conductor	mm ²	1.5/4	—	1.5/4	—	—
Solid cable without cable end	1 conductor	mm ²	1.5/4	—	1.5/4	—	—
Operating characteristics							
Temperature compensation		°C	- 20...+ 60	- 30...+ 60	- 30...+ 60		- 20...+ 60
Tripping threshold	Conforming to IEC 60947-4-1	A	1.14 ± 0.06 In				
Sensitivity to phase failure	Conforming to IEC 60947-4-1		Tripping current 30 % of In on one phase, the others at In				
Tripping curves							
Average operating times related to multiples of the setting current							

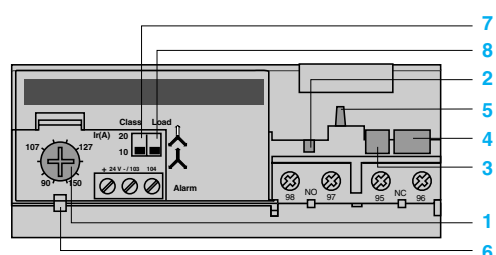


- 1 Balanced operation, 3-phase, from cold state.
- 2 2-phase operation, from cold state.
- 3 Balanced operation, 3-phase, after a long period at the set current (hot state).

Description



LR9 D5367...D5569





LR9 D67 and D69

LR9 D electronic thermal overload relays are designed for use with contactors LC1 D115 and D150.

In addition to the protection provided by model d thermal overload relays (see page 6/12) they offer the following special features:

- protection against phase imbalance,
- choice of starting class,
- protection of unbalanced circuits,
- protection of single-phase circuits,
- alarm function to avoid tripping by load shedding.

- 1 Adjustment dial I_r
- 2 Test button
- 3 Stop button
- 4 Reset button
- 5 Trip indicator
- 6 Setting locked by sealing the cover
- 7 Class 10/Class 20 selector switch
- 8 Selector for balanced load  /unbalanced load 

Environment

Conforming to standards			IEC 60947-4-1, 255-8, 255-17, VDE 0660 and EN 60947-4-1
Product certifications			UL 508 , CSA 22-2
Degree of protection	Conforming to IEC 60529 and VDE 0106		IP 20 on front panel with protective covers LA9 D11570● or D11560●
Protective treatment	Standard version		"TH"
Ambient air temperature around the device (conforming to IEC 60255-8)	Storage	°C	- 40...+ 85
	Normal operation	°C	- 20...+ 55 (1)
Maximum operating altitude	Without derating	m	2000
Operating positions without derating	In relation to normal vertical mounting plane		Any position
Shock resistance	Permissible acceleration conforming to IEC 60068-2-27		13 gn - 11 ms
Vibration resistance	Permissible acceleration conforming to IEC 60068-2-6		2 gn - 5 to 300 Hz
Dielectric strength at 50 Hz	Conforming to IEC 60255-5	kV	6
Surge withstand	Conforming to IEC 61000-4-5	kV	6
Resistance to electrostatic discharge	Conforming to IEC 61000-4-2	kV	8
Resistance to radio-frequency conducted disturbance	Conforming to IEC 61000-4-3 and NF C 46-022	V/m	10
Resistance to fast transient currents	Conforming to IEC 61000-4-4	kV	2
Electromagnetic compatibility	Draft EN 50081-1 and 2, EN 50082-2		Meet requirements

Electrical characteristics of auxiliary contacts

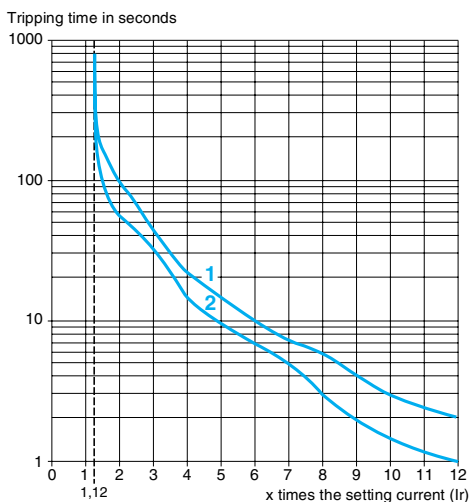
Conventional thermal current		A	5					
Maximum sealed current consumption of the operating coils of controlled contactors (Occasional operating cycles of contact 95-96)	a.c. supply	V	24	48	110	220	380	600
		VA	100	200	400	600	600	600
	d.c. supply	V	24	48	110	220	440	—
		W	100	100	50	45	25	—
Short-circuit protection	By gG or BS fuses or by circuit-breaker GB2	A	5					
Connection	1 or 2 conductors	mm²	Minimum c.s.a.: 1 Maximum c.s.a.: 2.5					
Flexible cable without cable end								
	Tightening torque	N.m	1.2					

(1) For operating temperatures up to 70 °C, please consult your Regional Sales Office.

Relay type		LR9 D	
Electrical characteristics of power circuit			
Tripping class	Conforming to UL 508, IEC 60947-4-1	A	10 or 20
Rated insulation voltage (Ui)	Conforming to IEC 60947-4-1	V	1000
	Conforming to UL, CSA	V	600
Rated impulse withstand voltage (Uimp)		kV	8
Frequency limits	Of the operating current	Hz	50...60. For other frequencies, please consult your Regional Sales Office (1)
Setting range	Depending on model	A	60...150
Power circuit connections	Width of terminal lug	mm	20
	Clamping screw		M8
	Tightening torque	N.m	18
Operating characteristics			
Temperature compensation		°C	- 20...+ 70
Tripping thresholds	Conforming to IEC 60947-4-1		
	Alarm	A	1.05 ± 0.06 In
	Tripping	A	1.12 ± 0.06 In
Sensitivity to phase failure	Conforming to IEC 60947-4-1		Tripping in 4 s ± 20 % in the event of phase failure
Alarm circuit characteristics			
Rated supply voltage	d.c. supply	V	24
Supply voltage limits		V	17...32
Current consumption	No-load	mA	≤ 5
Switching capacity		mA	0...150
Protection	Short-circuit and overload		Self protected
Voltage drop	Closed state	V	≤ 2.5
Cabling	Flexible cable without cable end	mm²	0.5...1.5
Tightening torque		N.m	0.45

(1) For applications involving the use of these overload relays with soft starters or variable speed drives, please consult your Regional Sales Office.

LR9 D tripping curve



Average operating times related to multiples of the setting current.



LRD 08●●



LRD 21●●



LRD 33●●



LRD 083●●

Differential thermal overload relays for use with fuses

- Compensated relays with manual or automatic reset,
- with relay trip indicator, ■ for a.c. or d.c.

Relay setting range (A)	Fuses to be used with selected relay			For use with contactor LC1	Reference	Weight kg
	aM (A)	gG (A)	BS88 (A)			
Class 10 A (1) with connection by screw clamp terminals or connectors						
0.10...0.16	0.25	2	—	D09...D38	LRD 01	0.124
0.16...0.25	0.5	2	—	D09...D38	LRD 02	0.124
0.25...0.40	1	2	—	D09...D38	LRD 03	0.124
0.40...0.63	1	2	—	D09...D38	LRD 04	0.124
0.63...1	2	4	—	D09...D38	LRD 05	0.124
1...1.6	2	4	6	D09...D38	LRD 06	0.124
1.6...2.5	4	6	10	D09...D38	LRD 07	0.124
2.5...4	6	10	16	D09...D38	LRD 08	0.124
4...6	8	16	16	D09...D38	LRD 10	0.124
5.5...8	12	20	20	D09...D38	LRD 12	0.124
7...10	12	20	20	D09...D38	LRD 14	0.124
9...13	16	25	25	D12...D38	LRD 16	0.124
12...18	20	35	32	D18...D38	LRD 21	0.124
16...24	25	50	50	D25...D38	LRD 22	0.124
23...32	40	63	63	D25...D38	LRD 32	0.124
30...38	40	80	80	D32 and D38	LRD 35	0.124
17...25	25	50	50	D40...D95	LRD 3322	0.510
23...32	40	63	63	D40...D95	LRD 3353	0.510
30...40	40	100	80	D40...D95	LRD 3355	0.510
37...50	63	100	100	D40...D95	LRD 3357	0.510
48...65	63	100	100	D50...D95	LRD 3359	0.510
55...70	80	125	125	D50...D95	LRD 3361	0.510
63...80	80	125	125	D65...D95	LRD 3363	0.510
80...104	100	160	160	D80 and D95	LRD 3365	0.510
80...104	125	200	160	D115 and D150	LRD 4365	0.900
95...120	125	200	200	D115 and D150	LRD 4367	0.900
110...140	160	250	200	D150	LRD 4369	0.900
80...104	100	160	160	(2)	LRD 33656	1.000
95...120	125	200	200	(2)	LRD 33676	1.000
110...140	160	250	200	(2)	LRD 33696	1.000
Class 10 A (1) with spring terminal connections (only for direct mounting on the contactor)						
0.10...0.16	0.25	2	—	D09...D38	LRD 013	0.140
0.16...0.25	0.5	2	—	D09...D38	LRD 023	0.140
0.25...0.40	1	2	—	D09...D38	LRD 033	0.140
0.40...0.63	1	2	—	D09...D38	LRD 043	0.140
0.63...1	2	4	—	D09...D38	LRD 053	0.140
1...1.6	2	4	6	D09...D38	LRD 063	0.140
1.6...2.5	4	6	10	D09...D38	LRD 073	0.140
2.5...4	6	10	16	D09...D38	LRD 083	0.140
4...6	8	16	16	D09...D38	LRD 103	0.140
5.5...8	12	20	20	D09...D38	LRD 123	0.140
7...10	12	20	20	D09...D38	LRD 143	0.140
9...13	16	25	25	D12...D38	LRD 163	0.140
12...18	20	35	32	D18...D38	LRD 213	0.140
16...24	25	50	50	D25...D38	LRD 223	0.140

Class 10 A (1) with connection by lug-clamps

Select overload relay with screw clamp terminals or connectors from the table above and add one of the following suffixes:

- figure 6 for relays LRD 01 to LRD 35, ■ A66 for relays LRD 3322 to LRD 3365.

The remaining references are suitable, as standard, for use with lug-clamps.

Thermal overload relays for use with unbalanced loads

Class 10 A (1) with connection by screw clamp terminals

In the references selected above, change LRD (except LRD 4●●●) to LR3 D. Example: LRD 01 becomes LR3 D01.

Thermal overload relays for use on 1000 V supplies

Class 10 A (1) with connection by screw clamp terminals

For relays LRD 06 to LRD 35 only, for an operating voltage of 1000 V, and only for independent mounting, the reference becomes LRD 33●●A66. Example: LRD 12 becomes LRD 3312A66.

Order an LA7 D3064 terminal block separately, see page 6/19.

(1) Standard IEC 60947-4-1 specifies a tripping time for 7.2 times the setting current I_R :
class 10 A: between 2 and 10 seconds.

(2) Independent mounting



LRD 15



LR2 D35

Differential thermal overload relays for use with fuses

- Compensated relays with manual or automatic reset,
- with relay trip indicator,
- for a.c. or d.c.

Relay setting range (A)	Fuses to be used with selected relay			For use with contactor LC1	Reference	Weight
	aM (A)	gG (A)	BS88 (A)			
Class 20 (1) with connection by screw clamp terminals						
2.5...4	6	10	16	D09...D32	LRD 1508	0.190
4...6	8	16	16	D09...D32	LRD 1510	0.190
5.5...8	12	20	20	D09...D32	LRD 1512	0.190
7...10	16	20	25	D09...D32	LRD 1514	0.190
9...13	16	25	25	D12...D32	LRD 1516	0.190
12...18	25	35	40	D18...D32	LRD 1521	0.190
17...25	32	50	50	D25 and D32	LRD 1522	0.190
23...28	40	63	63	D25 and D32	LRD 1530	0.190
25...32	40	63	63	D25 and D32	LRD 1532	0.190
17...25	32	50	50	D40...D95	LR2 D3522	0.535
23...32	40	63	63	D40...D95	LR2 D3553	0.535
30...40	50	100	80	D40...D95	LR2 D3555	0.535
37...50	63	100	100	D50...D95	LR2 D3557	0.535
48...65	80	125	100	D50...D95	LR2 D3559	0.535
55...70	100	125	125	D65...D95	LR2 D3561	0.535
63...80	100	160	125	D80 and D95	LR2 D3563	0.535

Electronic differential thermal overload relays for use with fuses

- Compensated relays, with relay trip indicator,
- for a.c.,
- for direct mounting on contactor or independent mounting (2).

Relay setting range (A)	Fuses to be used with selected relay		For direct mounting beneath contactor LC1	Reference	Weight
	aM (A)	gG (A)			
Class 10 or 10A (1) with connection using bars or connectors					
60...100	100	160	D115 and D150	LR9 D5367	0.885
90...150	160	250	D115 and D150	LR9 D5369	0.885
Class 20 (3) with connection using bars or connectors					
60...100	125	160	D115 and D150	LR9 D5567	0.885
90...150	200	250	D115 and D150	LR9 D5569	0.885

Electronic thermal overload relays for use with balanced or unbalanced loads

- Compensated relays,
- with separate outputs for alarm and tripping.

Relay setting range (A)	Fuses to be used with selected relay		For direct mounting beneath contactor LC1	Reference	Weight
	aM (A)	gG (A)			
Class 10 or 20 (1) selectable with connection using bars or connectors					
60...100	100	160	D115 and D150	LR9 D67	0.900
90...150	160	250	D115 and D150	LR9 D69	0.900

(1) Standard IEC 60947-4-1 specifies a tripping time for 7.2 times the setting current I_R :

class 10: between 4 and 10 seconds,
class 10 A: between 2 and 10 seconds,
class 20: between 6 and 20 seconds.

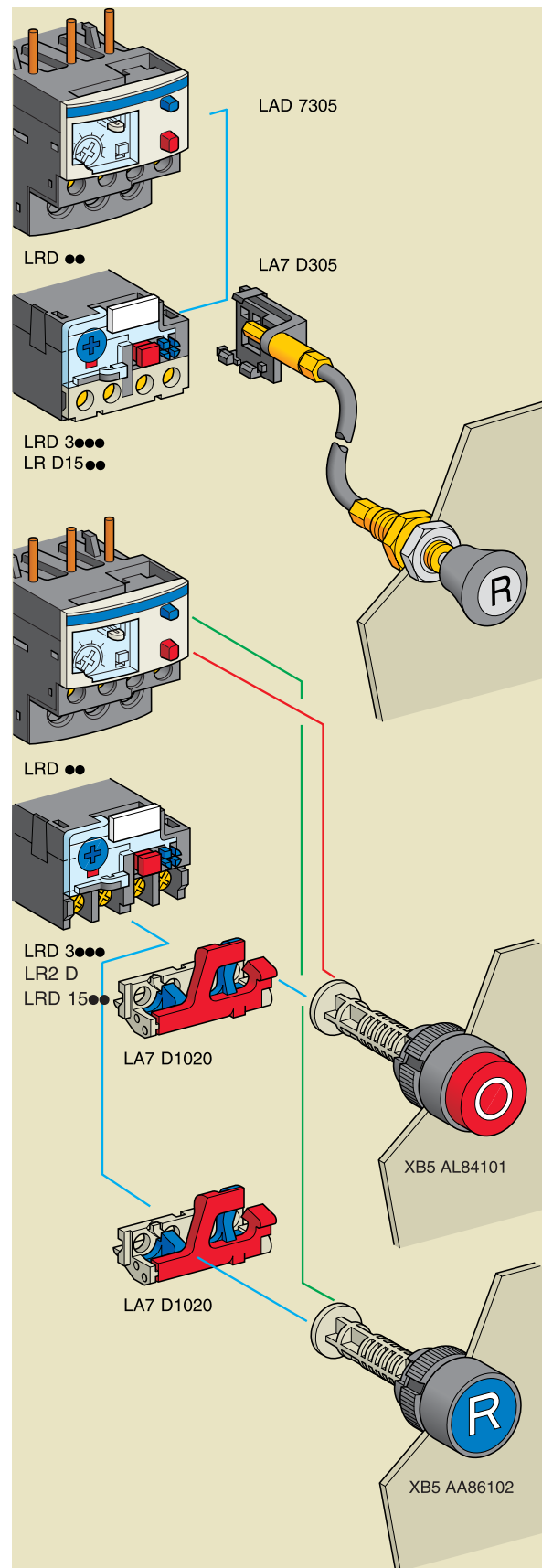
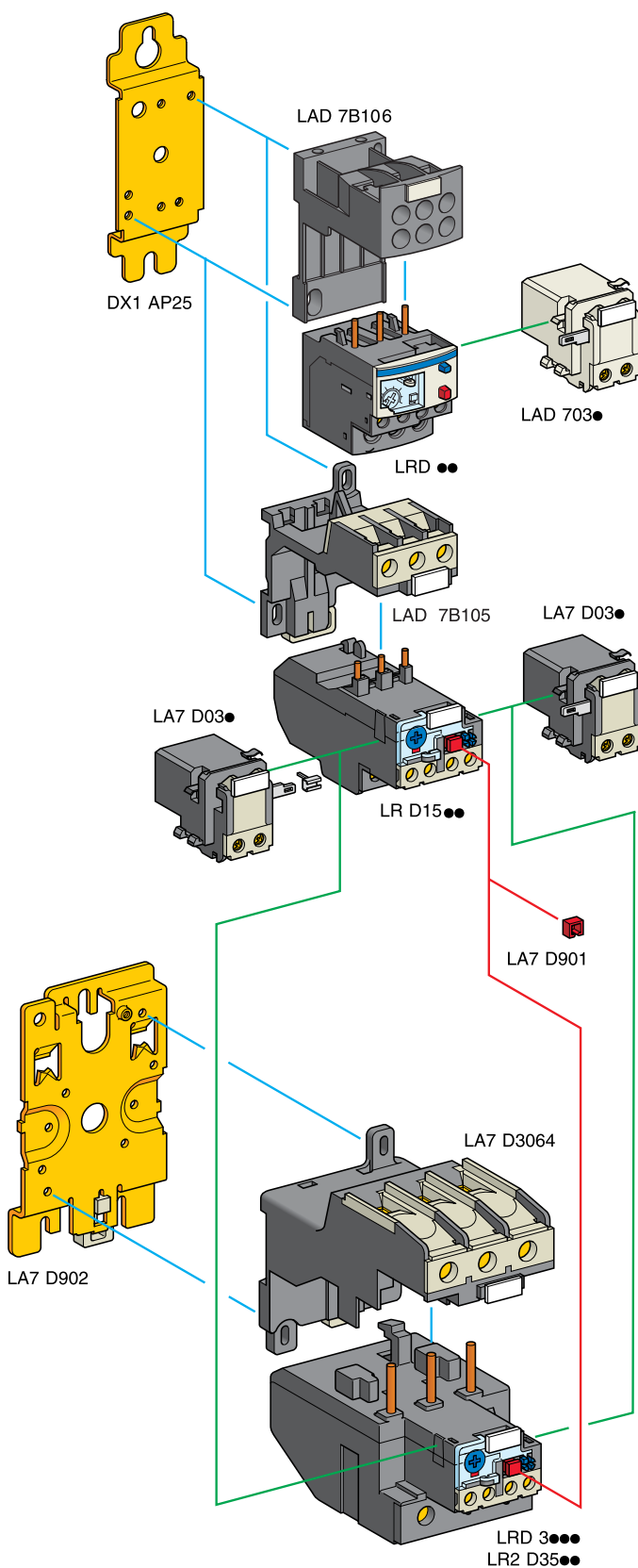
(2) Power terminals can be protected against direct finger contact by the addition of shrouds and/or insulated terminal blocks, to be ordered separately (see page 5/74).

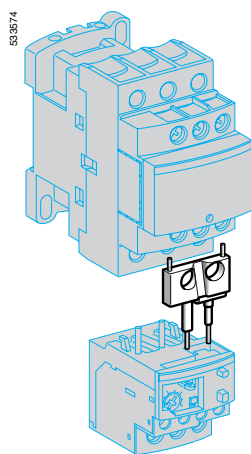
Other versions

Thermal overload relays for resistive circuits in category AC-1.
Please consult your Regional Sales Office.

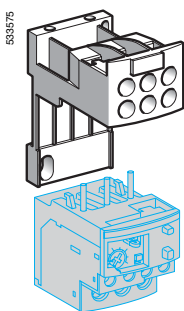
TeSys protection components

3-pole thermal overload relays, model d





LAD 7C1



LAD 7B106

Accessories (to be ordered separately)

Description	For use with	Sold in lots of	Unit reference	Weight kg
Pre-wiring kit allowing direct connection of the N/C contact of relay LRD 01...35 or LR3 D01...D35 to the contactor	LC1 D09...D18	10	LAD 7C1 (1)	0.002
	LC1 D25...D38	10	LAD 7C2 (1)	0.003
Terminal block (2) for clip-on mounting on 35 mm rail (AM1 DP200) or screw fixing; for fixing centres, see pages 6/20 to 6/22	LRD 01...35 and LR3 D01...D35	1	LAD 7B106	0.100
	LRD 1508...32	1	LAD 7B105	0.100
	LRD 3...35, LR3 D3...35, LR2 D35...35	1	LA7 D3064 (3)	0.370
Terminal block adapter for mounting a relay beneath an LC1 D115 or D150 contactor	LRD 3...35, LR3 D3...35, LRD 35...35	1	LA7 D3058 (3)	0.080
Mounting plates (4) for screw fixing on 110 mm centres	LRD 01...35, LR3 D01...D35, LRD 1508...32	10	DX1 AP25	0.065
	LRD 3...35, LR3 D3...35, LR2 D35...35	1	LA7 D902	0.130
Marker holder snap-in	All relays except LRD 01...35 and LR3 D01...D35 (5)	100	LA7 D903	0.001
Bag of 400 labels (blank, self-adhesive, 7 x 16 mm)	—	1	LA9 D91	0.001
Stop button locking device	All relays except LRD 01...35, LR3 D01...D35 and LR9 D	10	LA7 D901	0.005
Remote stop or electrical reset device (6)	LRD 01...35 and LR3 D01...D35	1	LAD 703 (7) (8)	0.090
Remote tripping or electrical reset device (6)	All relays except LRD 01...35 and LR3 D01...D35	1	LA7 D03 (7)	0.090
Block of insulated terminals	LR9 D	2	LA9 F103	0.560

Remote control

"Reset" function

Description	For use with	Sold in lots of	Unit reference	Weight kg
By flexible cable (length = 0.5 m)	LRD 01...35 and LR3 D01...D35	1	LAD 7305 (8)	0.075
	All relays except LRD 01...35 and LR3 D01...D35	1	LA7 D305	0.075

"Stop" and/or "Reset" functions

The terminal protection shroud must be removed and the following 3 products must be ordered separately:

Adapter for door mounting	All relays except LRD 01...35 and LR3 D01...D35		1	LA7 D1020	0.005
	Stop	All relays	1	XB5 AL84101	0.027
Operating heads for spring return pushbutton	Reset	All relays	1	XB5 AA86102	0.027

(1) These pre-wiring kits cannot be used with reversing contactors.

(2) Terminal blocks are supplied with terminals protected against direct finger contact and screws in the open, "ready-to-tighten" position.

(3) To order a terminal block for connection by lugs, the reference becomes LA7 D30646.

(4) Do not forget to order the terminal block corresponding to the type of relay.

(5) For LRD 01...35, see page 5/75.

(6) The time for which the coil of remote tripping or electrical resetting device LA7 D03 or LAD 703 can remain energised depends on its rest time: 1 s pulse duration with 9 s rest time; 5 s pulse duration with 30 s rest time; 10 s pulse duration with 90 s rest time; maximum pulse duration 20 s with a rest time of 300 s. Minimum pulse time: 200 ms.

(7) Reference to be completed by adding the code indicating control circuit voltage.

Standard control circuit voltages (for other voltages, please consult your Regional Sales Office):

Volts	12	24	48	96	110	220/230	380/400	415/440
50/60 Hz	—	B	E	—	F	M	Q	N
Consumption, inrush and sealed: < 100 VA								
—	J	B	E	DD	F	M	—	—

Consumption, inrush and sealed: < 100 W.

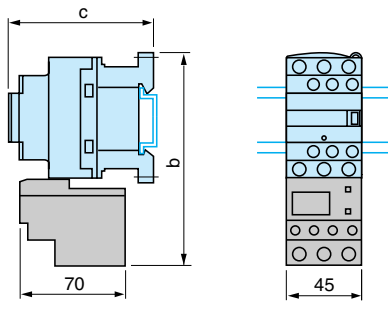
(8) Not compatible with 3-pole relays fitted with spring terminals.

TeSys protection components

Thermal overload relays, model d

LRD 01...35

Direct mounting beneath contactors with screw clamp connections



LC1

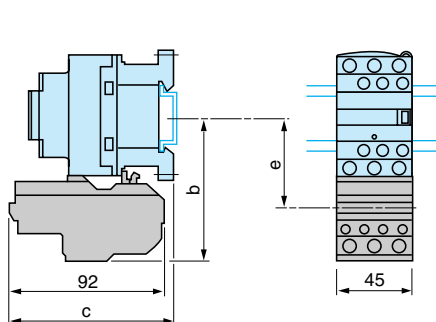
D09...D18

D25...D38

b	123	137
c	See pages 5/82 and 5/83	

LRD 1508...32

Direct mounting beneath contactors with screw clamp connections



LC1

~ D09 18

~ D25 38

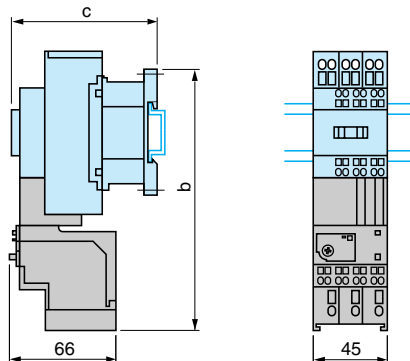
≡ D09 18

≡ D25 38

b	90	97	90	97
c	97	96	107	106
e	53	60	53	60

LRD 013...353

Direct mounting beneath contactors with spring terminal connections



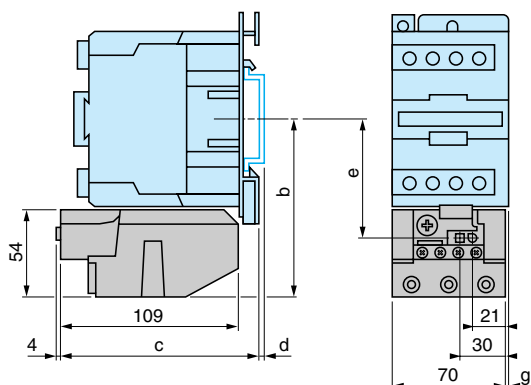
LC1

D03 D383

b	168
c	See pages 5/82 and 5/83

LRD 3●●●

Direct mounting beneath contactors LC1 D40...D95 and LP1 D40...D80



AM1

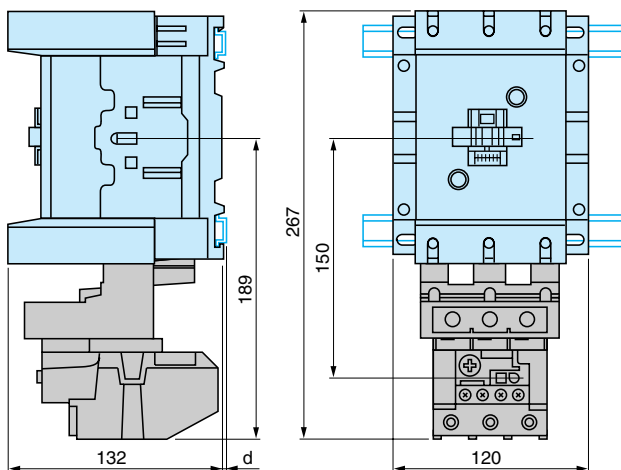
DL201

DL200

	b	c	e	g (3-pole)	g (4-pole)
Control circuit: a.c.					
LC1 D40	111	119	72.4	4.5	13
LC1 D50	111	119	72.4	4.5	—
LC1 D65	111	119	72.4	4.5	13
LC1 D80	115.5	124	76.9	9.5	22
LC1 D95	115.5	124	76.9	9.5	—
Control circuit: d.c.					
LC1 D40, LP1 D40	111	119	72.4	4.5	13
LC1 D50	111	176	72.4	4.5	—
LC1 D65, LP1 D65	111	176	72.4	4.5	13
LC1 D80, D95, LPA D80	115.5	179.4	76.9	9.5	22

LRD 4●●●

Direct mounting beneath contactors LC1 D115 and D150



AM1

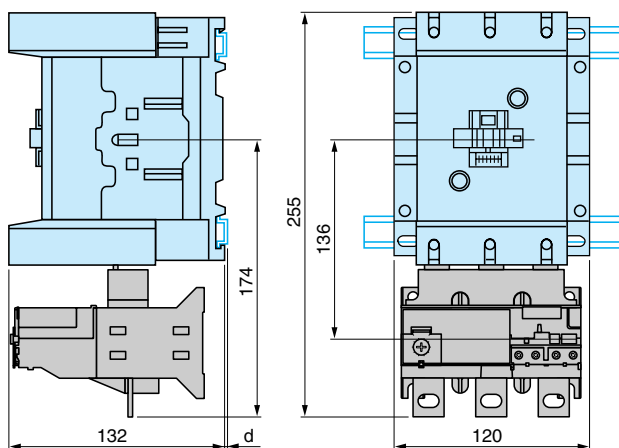
DL200 and DR200

DE200 and ED●●●

d	2.5	10.5
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LR9 D

Direct mounting beneath contactors LC1 D115 and D150



AM1

DP200 and DR200

DE200 and ED●●●

d	2.5	10.5
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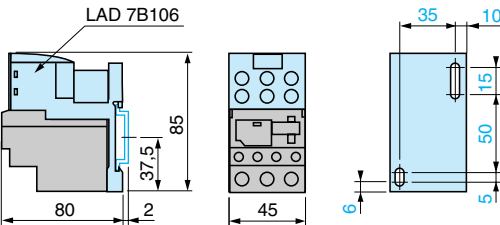
Characteristics:
pages 6/12 to 6/15

References:
pages 6/16 and 6/17

Schemes:
page 6/23

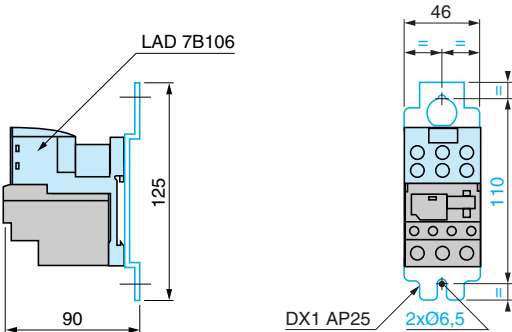
LRD 01...35

Independent mounting on 50 mm centres or on rail AM1 DP200 or DE200

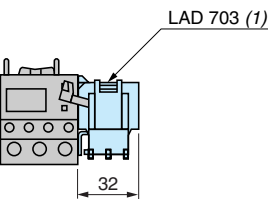


LRD 01...35

Independent mounting on 110 mm centres



Remote tripping or electrical reset

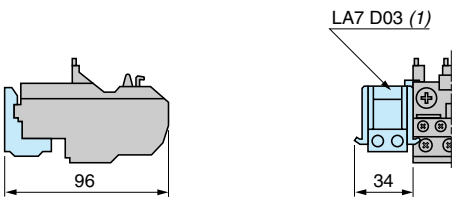
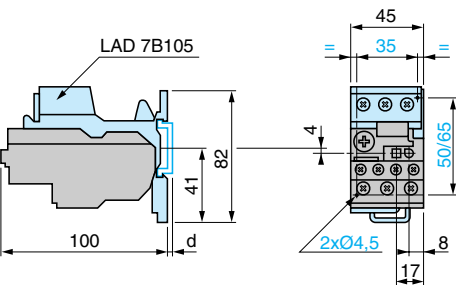


(1) Can only be mounted on RH side of relay LRD 01...35.

LRD 15●●

Independent mounting on 50 mm centres or on rail AM1 DP200 or DE200

Remote tripping or electrical reset

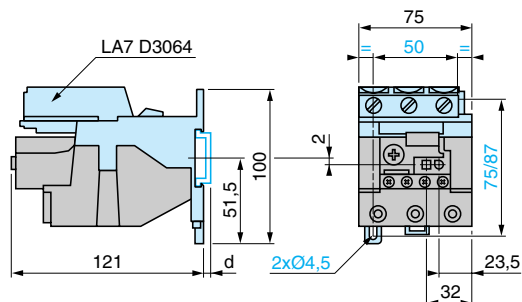


AM1	DP200	DE200
d	2	9.5

(1) Can be mounted on RH or LH side of relay LR2 D15.

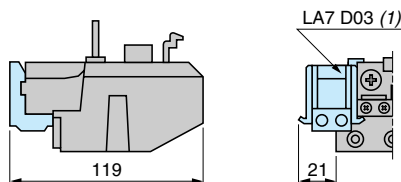
LRD 3●●● and LR2 D35●●

Independent mounting on 50 mm centres or on rail AM1 DP200 or DE200



LRD 3●●●, LR2 D35●● and LR9 D

Remote tripping or electrical reset



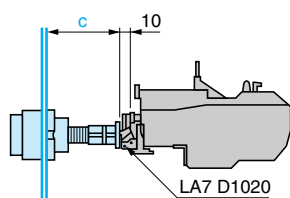
	AM1 DP200	AM1 DE200
d	2	9.5

(1) Can be mounted on RH or LH side of relay LRD 3●●●, LR2 D35●● or LR9 D.

LRD 15 and LRD 3●●●

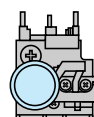
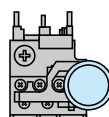
Adapter for door mounted operator

LA7 D1020



Stop

Reset



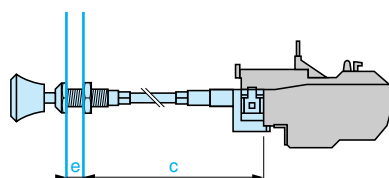
c : adjustable from 17 to 120 mm

LRD, LRD 15 and LR9 D

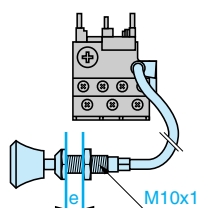
"Reset" by flexible cable

LA7 D305 and LAD 7305

Mounting with cable straight



Mounting with cable bent

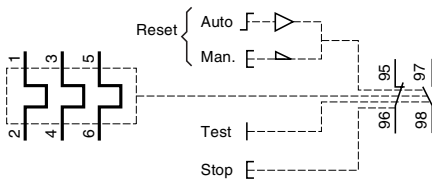


c : up to 550 mm

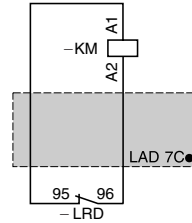
e : up to 20 mm

e : up to 20 mm

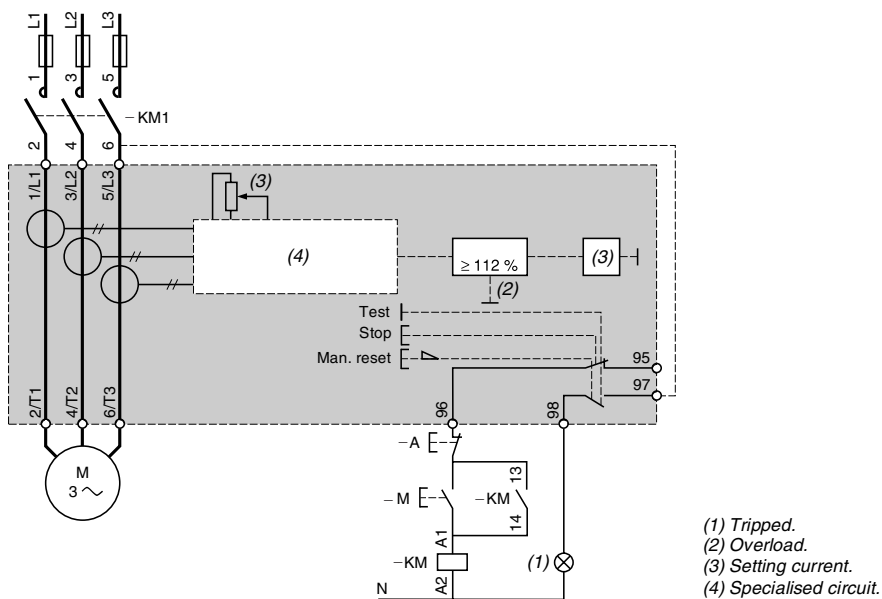
LRD, LR2 D and LR3 D



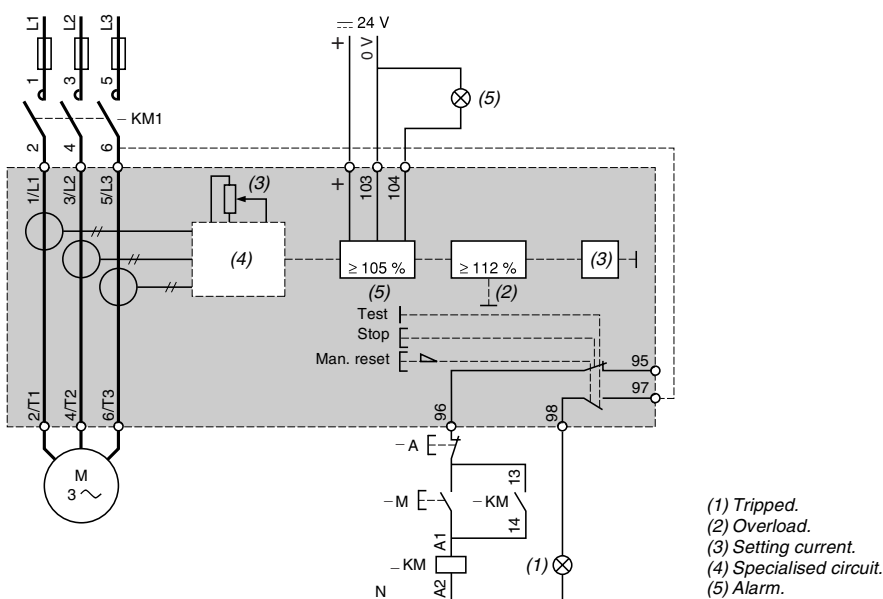
Pre-wiring kit LAD 7C1, LAD 7C2



LR9 D5●●●



LR9 D67 and LR9 D69



Protection components

3-pole electronic thermal overload relays, model LR9 F

Presentation

LR9 F electronic protection relays are especially suited to the operating conditions of motors.

They provide protection against:

- thermal overload of 3-phase or single-phase balanced or unbalanced circuits;
- phase failure and large phase unbalance,
- protracted starting times,
- prolonged stalled rotor condition.

LR9 F electronic protection relays are mounted directly below an LC1 F type contactor. They cover a range from 30 to 630 A, in eight ratings.

The settings can be locked by sealing the transparent protective cover.

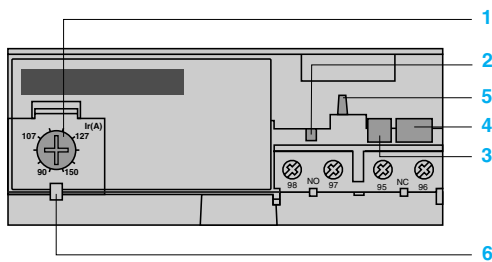
A reset button is mounted on the front of the relay.

Two versions are available:

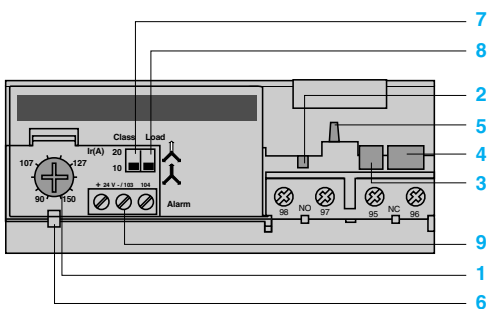
- simplified version: class 10: LR9 F●3●●, class 20: LR9 F●5●●,
- complete version: class 10, 10 A or class 20, selectable, conforming to EN 60947-4-1: LR9 F●●.



This latter version includes an alarm function which makes it possible to forestall tripping by load shedding.

Simplified version: class 10 or 20



Complete version: class 10, 10 A or class 20, selectable, and alarm circuit



- 1 Ir adjustment dial
- 2 Test button
- 3 Stop button
- 4 Reset button
- 5 Trip indicator
- 6 Setting locked by sealing the cover
- 7 Class 10/class 20 selector switch
- 8 Selector switch for balanced load  / unbalanced load 
- 9 Alarm circuit

Protection components

3-pole electronic thermal overload relays,
model LR9 F

Environment

Conforming to standards			IEC 60947-4-1, IEC 60255-8, IEC 60255-17, EN 60947-4-1 and VDE 0660
Product certifications			UL 508, CSA 22-2
Degree of protection	Conforming to VDE 0106		IP 20
	Conforming to IEC 60529		IP 20 on front of relay with accessories LA9 F103 or LA7 F70● , see page 6/31
Protective treatment	Standard version		"TH"
Ambient air temperature around the device (conforming to IEC 60255-8)	Storage	°C	- 40...+ 85
	Normal operation	°C	- 20...+ 55 (1)
Maximum operating altitude	Without derating	m	2000
Operating positions without derating	In relation to normal vertical mounting plane		Any position
Shock resistance	Permissible acceleration conforming to IEC 60068-2-7		13 gn - 11 ms
Vibration resistance	Permissible acceleration conforming to IEC 60068-2-6		2 gn - 5 to 300 Hz
Dielectric strength at 50 Hz	Conforming to IEC 255-5	kV	6
Surge withstand	Conforming to IEC 61000-4-5	kV	4
Resistance to electrostatic discharge	Conforming to IEC 61000-4-2	kV	8 (in air) 6 (in indirect mode)
Resistance to radiated radio-frequency disturbance	Conforming to IEC 61000-4-3	V/m	10
Resistance to fast transient currents	Conforming to IEC 61000-4-4	kV	2
Electromagnetic compatibility	EN 50081-1 and 2, EN 50082-2		Conforming

(1) For operating temperatures up to 70 °C, please consult your Regional Sales Office.

Electrical characteristics of power circuit

Relay type		LR9	F5●57, F57	F5●63, F63 F5●67, F67 F5●69, F69	F5●71, F71	F7●75, F75 F7●79, F79	F7●81, F81
Rated insulation voltage (Ui)	Conforming to IEC 60947-4	V	1000				
Rated operational voltage (Ue)	Conforming to VDE 0110 gr C	V	1000				
Rated impulse withstand voltage (Uimp)	Conforming to IEC 60947-1	kV	8				
Rated operational current (Ie)		A	30 to 630				
Short-circuit protection and coordination			See pages: 24540/2, 24540/3, 24544/2 and 24544/3				
Frequency limits	Of the operating current	Hz	50...60. For other frequencies, please consult your Regional Sales Office (1)				
Power circuit connections	Width of terminal lug	mm	20	25	25	30 LR9 F7●75 and LR9 F75 40 LR9 F7●79 and LR9 F79	40
	Clamping screw		M6	M8	M10	M10	M12
	Tightening torque	N.m	10	18	35	35	58

Auxiliary contact electrical characteristics

Conventional thermal current			A	5				
Short-circuit protection	By gG or BS fuses or by circuit-breaker GB2 CD10		A	5				
Control circuit connections	Flexible cable with cable end	1 conductor	mm ²	Min.			Max.	
				1 x 0.75			1 x 2.5	
		2 conductors	mm ²	2 x 1			2 x 1.5	
	Flexible cable without cable end	1 conductor	mm ²	1 x 0.75			1 x 4	
		2 conductors	mm ²	2 x 1			2 x 2.5	
	Solid cable	1 conductor	mm ²	1 x 0.75			1 x 2.5	
		2 conductors	mm ²	2 x 1			—	
	Tightening torque		N.m	1.2				
	Maximum sealed current consumption of the coils of associated contactors (occasional operating cycles of contact 95-96)	a.c. supply	V	24	48	110	220	380
VA			100	200	400	600	600	600
d.c. supply		V	24	48	110	220	440	—
		W	100	100	50	45	25	—

(1) For applications involving the use of these overload relays with soft starters or variable speed drives, please consult your Regional Sales Office.

Protection components

3-pole electronic thermal overload relays, model LR9 F

Operating characteristics

Tripping class	Conforming to IEC 60947-4-1		10, 10 A and 20
Temperature compensation		°C	- 20...+ 70
Reset			Manual on front of relay
Fault indication			On front of relay
Test function			On front of relay
Stop function			Actuation of N/C contact, without affecting N/O contact
Tripping thresholds	Conforming to IEC 60947-4-1	Alarm	A 1.05 ± 0.06 I _n
		Tripping	A 1.12 ± 0.06 I _n
Sensitivity to phase failure	Conforming to IEC 60947-4-1		Tripping in 4 s ± 20 % in the event of phase failure
Adjustment (nominal motor current)			Setting dial on front of relay
Security sealing			Yes

Alarm circuit characteristics

Rated supply voltage	d.c. supply	V	24
Supply voltage limits		V	17...32
Current consumption	No-load	mA	≤ 5
Switching current		mA	0...150
Protection	Short-circuit and overload		Auto-protected
Voltage drop	Closed state	V	≤ 2.5
Connection	Flexible cable without cable end	mm ²	0.5...1.5
Tightening torque		N.m	0.45

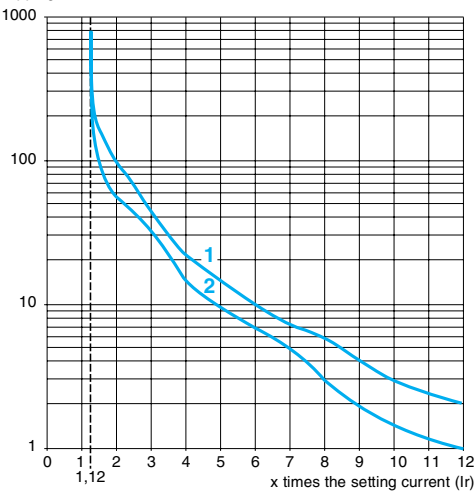
LR9 F tripping curve

Average operating times depending on multiples of the setting current

Class 10

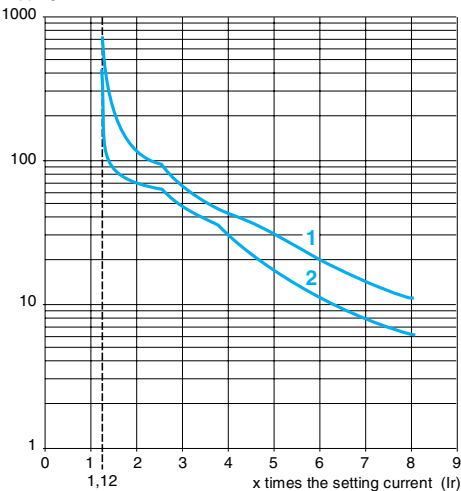
Class 20

Tripping time in seconds



- 1 Cold state curve
- 2 Hot state curve

Tripping time in seconds



Protection components

3-pole electronic thermal overload relays, model LR9 F for motor protection



LR9 F53●●



LR9 F73●●

Compensated and differential overload relays

Thermal overload relays:

- compensated and differential,
- with relay trip indicator,
- for a.c.,
- for direct mounting on contactor or independent mounting (1).

Relay setting range	Fuses to be used with selected relay		For direct mounting beneath contactor LC1	Reference	Weight
	aM	gG			
A	A	A			kg
Class 10 (2)					
30...50	50	80	F115...F185	LR9 F5357	0.885
48...80	80	125	F115...F185	LR9 F5363	0.900
60...100	100	200	F115...F185	LR9 F5367	0.900
90...150	160	250	F115...F185	LR9 F5369	0.885
132...220	250	315	F185...F400	LR9 F5371	0.950
200...330	400	500	F225...F500	LR9 F7375	2.320
300...500	500	800	F225...F500	LR9 F7379	2.320
380...630	630	800	F400...F630 and F800	LR9 F7381	4.160
Class 20 (2)					
30...50	50	80	F115...F185	LR9 F5557	0.885
48...80	80	125	F115...F185	LR9 F5563	0.900
60...100	100	200	F115...F185	LR9 F5567	0.900
90...150	160	250	F115...F185	LR9 F5569	0.885
132...220	250	315	F185...F400	LR9 F5571	0.950
200...330	400	500	F225...F500	LR9 F7575	2.320
300...500	500	800	F225...F500	LR9 F7579	2.320
380...630	630	800	F400...F630 and F800	LR9 F7581	4.160

- (1) When mounting overload relays up to size **LR9 F5371** directly beneath the contactor, they may be additionally supported by a mounting plate (see page 6/31). Above this size it is always necessary to use the mounting plate.
Power terminals can be protected against direct finger contact by the addition of shrouds and/or insulated terminal blocks, to be ordered separately (see page 6/31).
- (2) Standard IEC 60947-4 specifies a tripping time for 7.2 times the setting current I_n :
- class 10: between 4 and 10 seconds,
 - class 20: between 6 and 20 seconds.

Protection components

3-pole electronic thermal overload relays, model LR9 F for motor protection

Compensated overload relays, class 10 or 20 with alarm

Thermal overload relays:

- compensated,
- with relay trip indicator,
- for a.c.,
- for direct mounting on contactor or independent mounting (1),
- class 10 or 20 by selector switch,
- protection of 3-phase or single-phase circuits by selector switch,
- with alarm function that enables tripping to be forestalled.

Relay setting range	Fuses to be used with selected relay		For direct mounting beneath contactor LC1	Reference	Weight
	aM	gG			
A	A	A			kg
30...50	50	80	F115...F185	LR9 F57	0.885
48...80	80	125	F115...F185	LR9 F63	0.900
60...100	100	200	F115...F185	LR9 F67	0.900
90...150	160	250	F115...F185	LR9 F69	0.885
132...220	250	315	F185...F400	LR9 F71	0.950
200...330	400	500	F225...F500	LR9 F75	2.320
300...500	500	800	F225...F500	LR9 F79	2.320
380...630	630	800	F400...F630 and F800	LR9 F81	4.160

(1) When mounting overload relays up to size **LR9 F71** directly beneath the contactor, they may be additionally supported by a mounting plate (see page 6/31). Above this size it is always necessary to use the mounting plate.
Power terminals can be protected against direct finger contact by the addition of shrouds and/or insulated terminal blocks, to be ordered separately (see page 6/31).

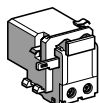


LR9 F57

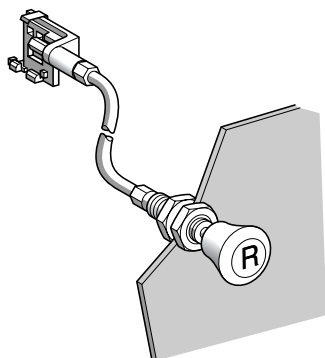
Protection components

3-pole electronic thermal overload relays, model LR9 F

Accessories (to be ordered separately)



LA7 D03●



LA7 D305

Control accessories

Description	Sold in lots of	Unit reference	Weight kg	
Remote electrical reset device (1)	1	LA7 D03● (2)	0.090	
Remote Reset function control by flexible cable (length = 0.5 m)	1	LA7 D305	0.075	
Remote Stop and/or Reset function control	Adapter for door mounted operator	1	LA7 D1020	0.005
	Rod (snap-off end to obtain required length, between 17 and 120 mm)	10	ZA2 BZ13	0.100
	Operating head for spring return pushbutton	1	ZA2 B●●●● (3)	0.012

Connection accessories

For mounting an LR9 F5●71 thermal overload relay together with an LC1 F185 contactor

Description	Reference	Weight kg
Set of 3 busbars	LA7 F407	0.160

For mounting a thermal overload relay beneath a reversing contactor or star-delta contactors

Application		Width of terminal lug	Set of 3 busbars Reference	Weight
For relay	For contactor			
		mm		kg
LR9 F5●57, F5●63, F5●67, F5●69, F69, F71	LC1 F115	15	LA7 F401	0.110
LR9 F5●57, F5●63	LC1 F150, F185	20	LA7 F402	0.110
LR9 F5●71, LR9 F71	LC1 F185	25	LA7 F407	0.160
LR9 F5●71, LR9 F71	LC1 F225, F265	25	LA7 F403	0.160
LR9 F7●75, F7●79, LR9 F75, F79	LC1 F225...F400	25	LA7 F404	0.160
LR9 F7●81, LR9 F81	LC1 F400	25	LA7 F404	0.160
LR9 F7●75, F7●79, F7●81, LR9 F75, F79, F81	LC1 F500	30	LA7 F405	0.270
LR9 F7●81, LR9 F81	LC1 F630, F800	40	LA7 F406	0.600

(1) The time for which the coil of remote electrical reset device **LA7 D03** can remain energised depends on its rest time: 1 s pulse duration with 9 s rest time; 5 s pulse duration with 30 s rest time; 10 s pulse duration with 90 s rest time. Maximum pulse duration of 20 s with rest time of 300 s. Minimum pulse time: 200 ms.

(2) Reference to be completed by adding the coil voltage code.
Standard control circuit voltages,
(for other voltages, please consult your Regional Sales Office) :

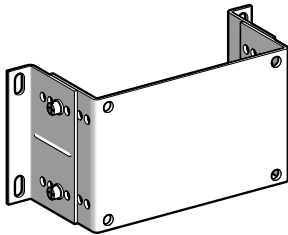
Volts	12	24	48	96	110	220/ 230	380/ 400	415/ 440
~ 50/60 Hz	—	B	E	—	F	M	Q	N
Consumption, inrush and sealed: < 100 VA								
—	J	B	E	DD	F	M	—	—
Consumption, inrush and sealed: < 100 W.								

(3) Stop: **ZA2 BL432** and Reset: **ZA2 BL639**.

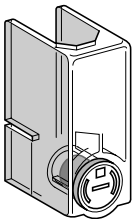
Protection components

3-pole electronic thermal overload relays,
model LR9 F

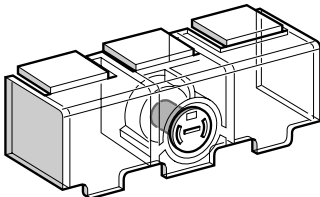
Accessories (to be ordered separately)



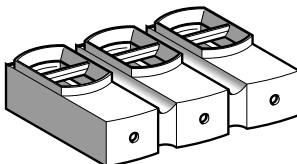
LA7 F90●



LA9 F70●



LA7 F70●



LA9 F103

Mounting plates for overload relay

For use with relays	Reference	Weight kg
LR9 F5●57, F5●63, F5●67, F5●69, F5●71, LR9 F57, F63, F67, F69, F71	LA7 F901	0.100
LR9 F7●75, F7●79, F7●81, LR9 F75, F79, F81	LA7 F902	0.100

Sets of power terminal protection shrouds, single-pole

For use with relays	Number of shrouds per set	Set reference	Weight kg
LR9 F5●57, LR9 F57	6	LA9 F701	0.015
LR9 F5●63, F5●67, F5●69, LR9 F63, F67, F69	6	LA9 F702	0.015
LR9 F5●71, LR9 F71	6	LA9 F705	0.015
LR9 F7●75, F7●79, F7●81, LR9 F75, F79, F81	6	LA9 F703	0.015

Power terminal protection shrouds, 3-pole

For use with relays	Reference	Weight kg
LR9 F5●57, F5●63, F5●67, F5●69, LR9 F57, F63, F67, F69	LA7 F701	0.030
LR9 F5●71, LR9 F71	LA7 F702	0.030
LR9 F7●75, F7●79, F7●81, LR9 F75, F79, F81	LA7 F703	0.030

Insulated terminal blocks

For use with relays	Set of 2 blocks Reference	Weight kg
LR9 F5●57, F5●63, F5●67, F5●69, LR9 F57, F63, F67, F69	LA9 F103	0.560

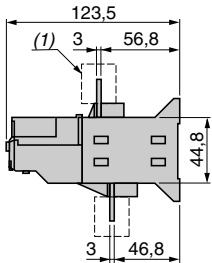
Marking accessories

Description	Sold in lots of	Unit reference	Weight kg
Clip-in marker holder	100	LA7 D903	0.001
Bag of 400 blank self-adhesive legends 7 x 16 mm	1	LA9 D91	0.001

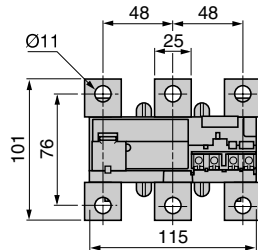
Protection components

3-pole electronic thermal overload relays,
model LR9 F

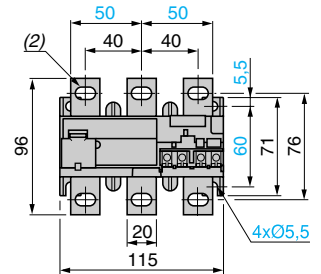
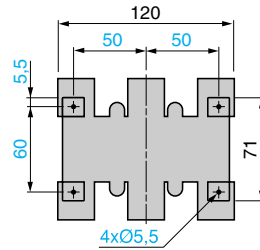
Common side view



LR9 F5071, F71



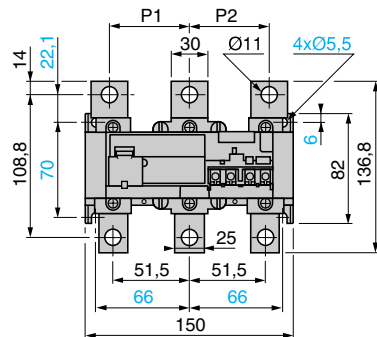
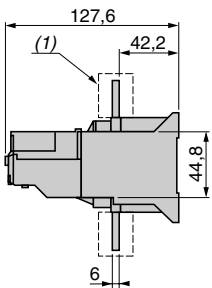
LR9 F5057, F5063, F5067,
LR9 F5069, F57, F63, F67, F69



(1) Terminal shroud LA9 F700

(2) 6.5 x 13.5 for LR9 F5057 and F57. 8.5 x 13.5 for LR9 F5063, F5067, F5069, F63, F67, F69

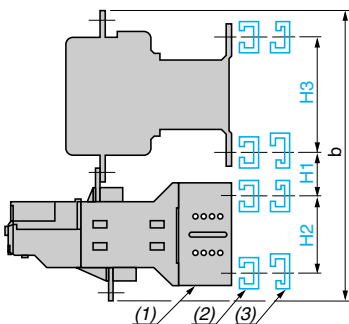
Common side view



(1) Terminal shroud
LA9 F700

	P1	P2
LR9 F7075, F75	48	48
LR9 F7079, F7081, F79, F81	55	55

Direct mounting beneath contactor LC1 F

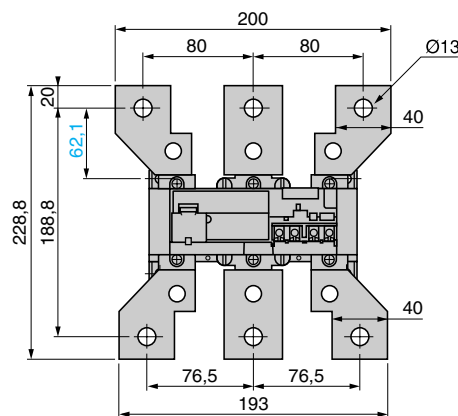


Contactors LC1	With LR9 relays	b	H1	H2	H3
F115	F5057, F5063, F5067, F5069, F57, F63, F67, F69	240	30	50	120
F150	F5057, F5063, F5067, F5069 F57, F63, F67, F69	246	30	50	120
F185	F5057, F5063, F5067, F5069 F57, F63, F67, F69	250	30	50	120
F225	F5071, F71	273	40	50	120
	F7075, F7079, F75, F79	308	50	58	120
F265	F5071, F71	279	40	50	120
	F7075, F7079, F75, F79	314	60	58	120
F330	F7075, F7079, F75, F79	317	60	58	120
F400	F7075, F7079, F7081, F75, F79, F81	317	60	58	180
F500	F7075, F7079, F7081, F75, F79, F81	346	70	58	180
F630, F800	F7081, F81	510	110	58	180

(1) Relay mounting plate LA7 F900, see page 6/31

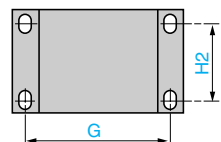
(2) AM1 EC or AM1 DF for LC1 F115 to F630 and LC1 F800

LR9 F7081 (for mounting beneath LC1 F630 and F800),
LR9 F81

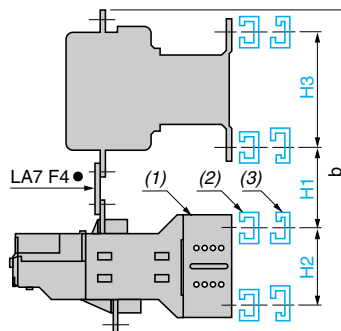


Mounting beneath contactors:
reversing LC2 F or star-delta LC3 F

Mounting plate
for LR9 F



LA7	G
F901	145
F902	190



Contactors LC1	With LR9 relays	b	H1	H2	H3
F115	F5057, F5063, F5067, F5069, F57, F63, F67, F69	279	60	50	120
F150	F5057, F5063, F5067, F5069 F57, F63, F67, F69	283	60	50	120
F185	F5057, F5063, F5067, F5069 F57, F63, F67, F69	285	60	50	120
F225	F5071, F71	360	100	58	120
	F7075, F7079, F75, F79	363	100	58	120
F265	F5071, F71	332	90	50	120
	F7075, F7079, F75, F79	364	100	58	120
F330	F7075, F7079, F75, F79	364	100	58	120
F400	F7075, F7079, F7081, F75, F79, F81	364	100	58	180
F500	F7075, F7079, F7081, F75, F79, F81	390	110	58	180
F630, F800	F7081, F81	509	120	58	180

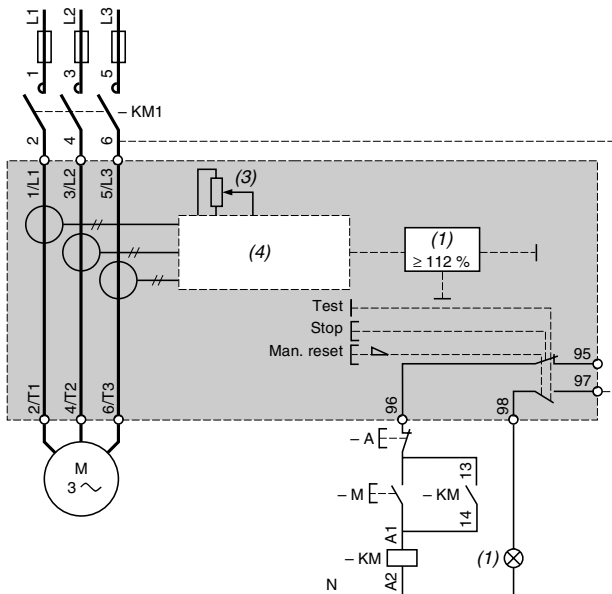
(3) DZ5 MB for LC1 F115 to F400

Protection components

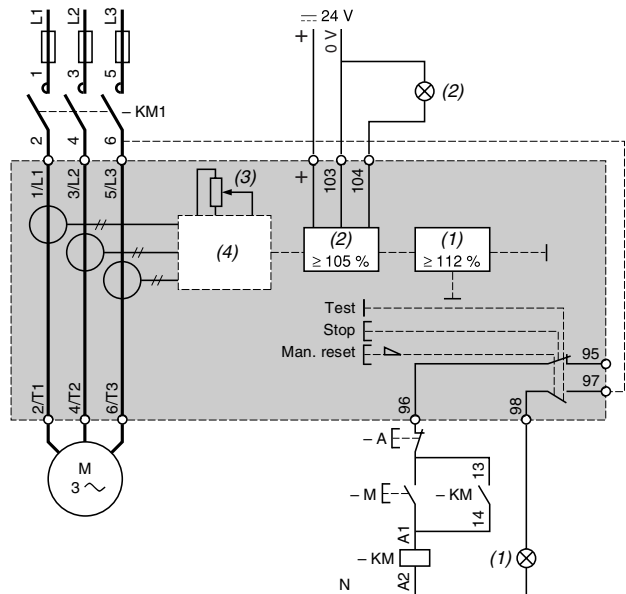
3-pole electronic thermal overload relays,
model LR9 F

Schemes

LR9 F5...F7...F81



LR9 F57...F81 (with alarm)

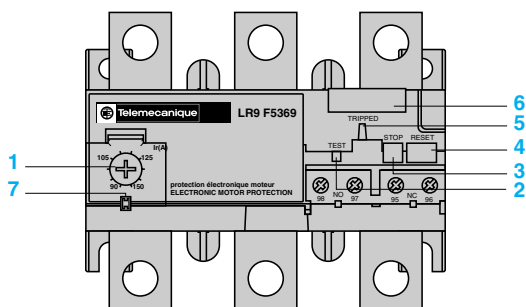


- (1) Tripped on thermal overload
- (2) Overheating alarm
- (3) Setting current
- (4) Specialised circuit

Setting-up the special functions of LR9 F thermal overload relays

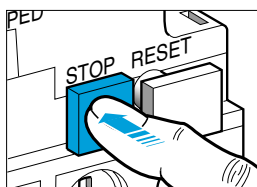
Setting the relay

- Lift the transparent cover 7 to gain access to the various settings.
- Adjustment is achieved by turning dial 1 which is graduated directly in Amperes.
- The setting can be locked by sealing the cover 7.



"Stop" function 3

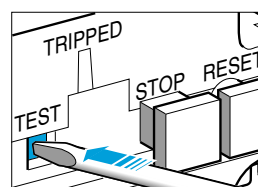
Stop



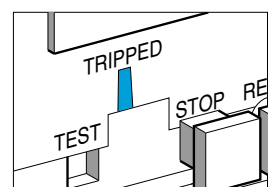
- The "Stop" function is obtained by pressing the red "STOP" button 3.
- Pressing the Test button:
 - actuates the N/C contact,
 - has no effect on the N/O contact.
- The "STOP" button can be locked by fitting a "U" clip (reference: LA7 D901).

"Test" function 2

Test



Trip indicator



- The "Test" function is obtained by pressing the red "TEST" button 2 with a screwdriver.
- Operation of the "TEST" button simulates tripping of the relay and:
 - actuates both the N/O and N/C contacts,
 - actuates the trip indicator 5.

Presentation



LR97 D



LT47

LR97 D and LT47 electronic over current relays have been developed to satisfy machine protection requirements. These relays have definite time characteristics: current threshold and time based function. They are particularly recommended for providing mechanical protection on machines with high resistive torque, high inertia and with strong probability of jamming under steady state conditions. They can be used for motor protection in the case of long starting times or frequent starting. The LR97 D relay also incorporates two fixed time protection functions, one of 0.5 seconds against locked rotor and one of 3 seconds against phase failure. LR97 D and LT47 can be used to provide mechanical shock protection. In this case, setting the O-Time knob to minimum will ensure tripping in 0.3 seconds.

Applications

LR97 D and LT47 relays are particularly suitable for the following machines:

- Monitoring function for excessively long starting time on machines with a risk of difficult starting:
 - Machines with high resistive torque, high inertia machines.
- Monitoring of machines during steady state operation: overtorque detection function
 - Machines with strong risk of jamming, machines with torque build-up over time,
 - Mechanical failure monitoring,
 - Faster detection of malfunctioning on machines where the motor is oversized in relation to its thermal protection I^2t .
- Motor protection for specific applications:
 - Machines with long starting times,
 - Machines with high on-load factor: more than 30 to 50 starts/hour,
 - Machine with fluctuating load from a steady state, where the thermal image of a thermal overload relay (thermal memory) is unsuitable in relation to actual overheating of the motor.

Examples of machines:

- Conveyors, crushers and mixers,
- Fans, pumps and compressors,
- Centrifuges and spin-dryers,
- Presses, shearing machines, saws, broaching machines, sanders and lifting hoists.

Operation

Because of their two separate time settings, LR97 D and LT47 relays can be combined with the motor-starter function:

D-Time: starting time, O-Time: trip time during steady state.

The D-Time function is only available during the motor starting phase. During this phase the overload detection function is inhibited in order to allow starting. Under steady state conditions, when the motor current is greater than the setting current due to an overload or single-phasing, the red LED lights up and the internal relay switches its contact after a time preset by the O-Time knob.

The red LED stays on, indicating that the relay has tripped.

The relays are simple to set, in 5 easy steps:

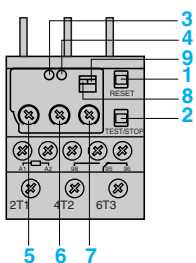
- Adjust the 3 knobs to maximum (Load, D-Time and O-Time),
- Adjust the D-Time knob to the value corresponding to the motor starting time.
- When the motor reaches steady state, adjust the Load knob (turn the knob counter-clockwise until the red LED starts to flicker).
- Slowly turn the Load knob clockwise until the LED goes out.
- Set the required tripping time, using the O-Time knob.

Description

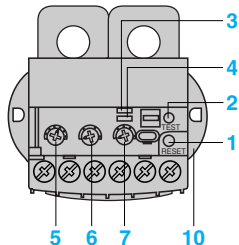
Description

LR97 D ●●●●●

LT47 ●●●●●



- 1 RESET knob
- 2 TEST/STOP knob
- 3 Ready/Run Indicator
- 4 Relay tripped indicator
- 5 Current setting
- 6 Adjustment of starting time



- 7 Adjustment of tripping time
- 8 Manual/Auto adjustment
- 9 Single-phase/3-phase adjustment
- 10 Retractable fixing lugs

Status signalling

LR97 D ●●●●●

LT47 ●●●●●

To assist fast diagnostics, two LEDs (one green and one red) allow signalling of the operating status:

Status	LED signal	
	Green LED	Red LED
Voltage	On	Off
Starting		
Steady state	On	Off
Overload	On	
Trip	Over-current	Off
	Rotor locked	Off
	Phase failure	Off
	L1	Off
	L2	Off
	L3	Off

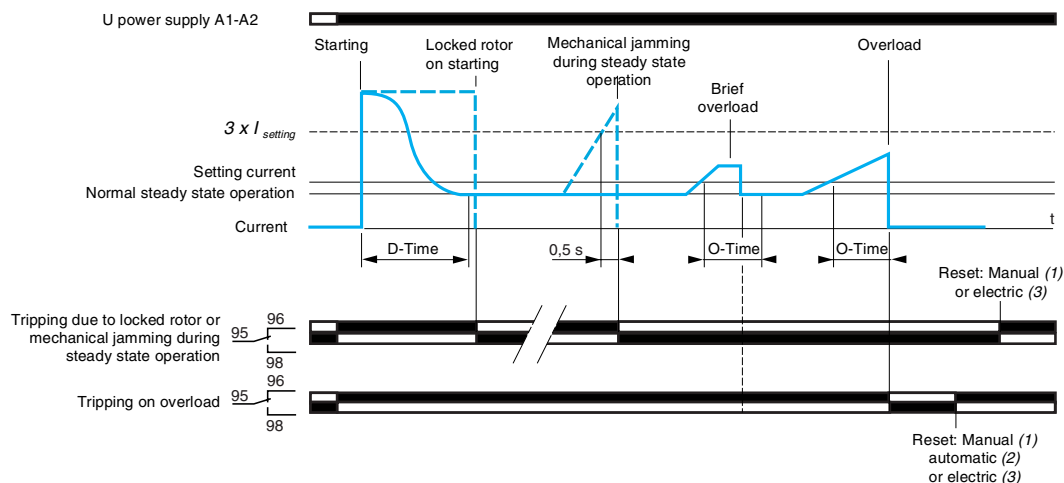
Condition	LED signal	
	Green LED	Red LED
Voltage	On	Off
Starting		
Steady state	On	Off
Overload	On	
Trip	Off	On

Curves

LR97 D

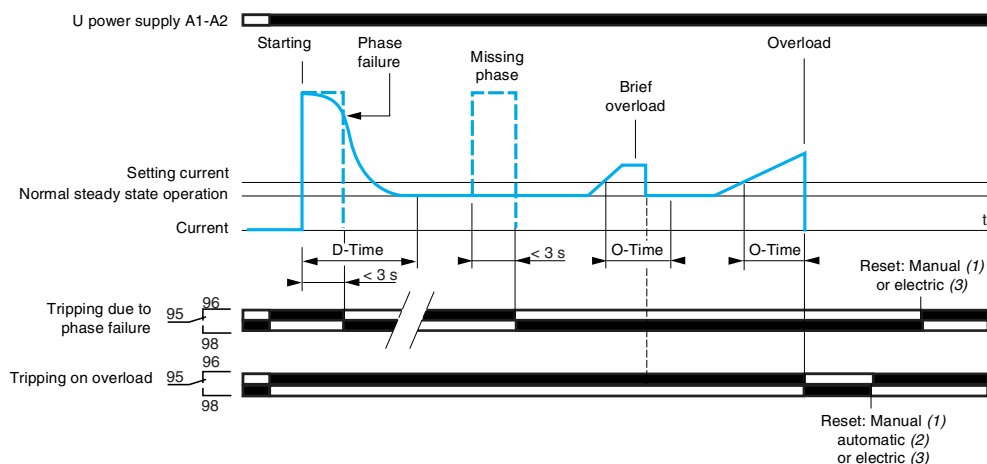
Overload protection

Protection against locked rotor and mechanical jamming under steady state conditions

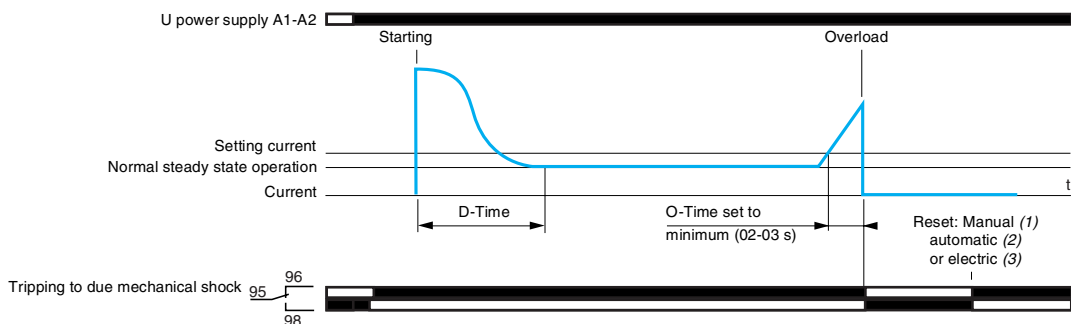


Overload protection

Protection against phase failure during starting and during steady state operation



Mechanical shock protection



(1) By Reset button.

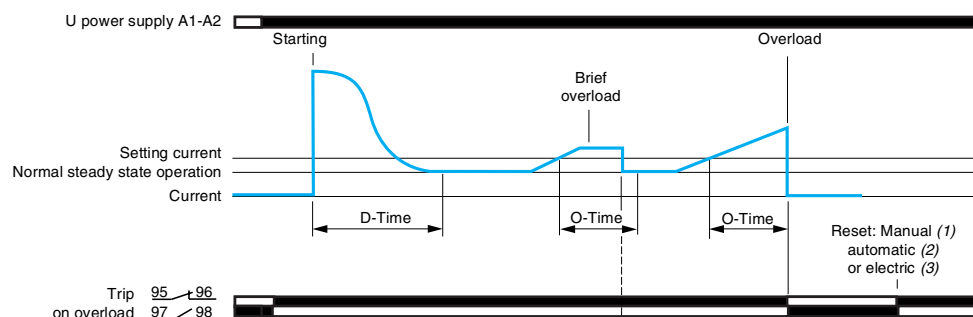
(2) Fixed time of 120 s. Selectable by dip switch. Function not available in the event of tripping due to locked rotor/mechanical jamming ($I > 3 \times I_{setting}$) or phase failure.

(3) By brief interruption of power supply, minimum 0.1 s.

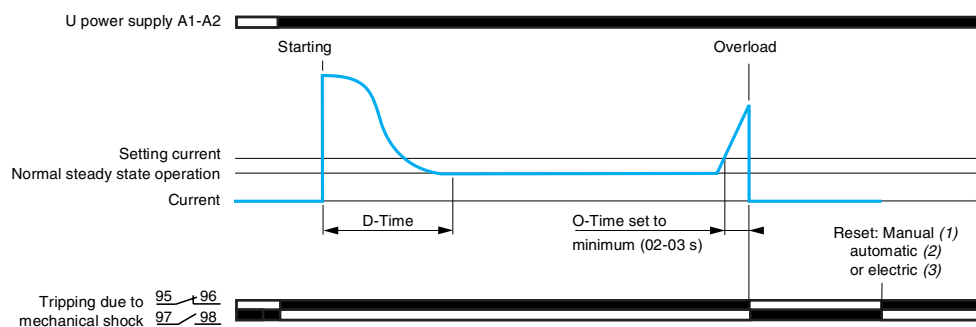
Curves (continued)

LT47

Overload protection



Mechanical shock protection



(1) By Reset button.

(2) Only available on version with automatic reset (LT47 ●●●●A). Time adjustable from 1 to 120 s with the R-Time knob.

(3) By brief interruption of power supply, minimum 0.1 s.

Characteristics

Environment

Relay type		LR97 D●●●●●	LT47 ●●●●●
Conforming to standards		IEC 60255-6, IEC 60947	IEC 60255-6, IEC 60947
Product certifications		UL, CSA	UL, CSA
Degree of protection	Conforming to IEC 60529 and VDE 0106	IP 20 (front face)	IP 20 (front face)
Protective treatment	Conforming to IEC 60068	"TH"	"TH"
Ambient air temperature around the device	Storage	°C - 30...+ 80	- 30...+ 80
	Normal operation without derating (IEC 60947-4-1)	°C - 25...+ 60	- 25...+ 60
Maximum operating altitude	m	2000	2000
Operating positions without derating	In relation to normal vertical mounting plane	Any position	Any position
Shock resistance	Permissible acceleration conforming to IEC 60068-2-7	15 gn - 11 ms	15 gn - 11 ms
Vibration resistance	Permissible acceleration conforming to IEC 60068-2-6	4 gn	4 gn
Dielectric strength at 50 Hz	Conforming to IEC 60255-5	kV 2	2
Surge withstand	Conforming to IEC 61000-4-5	kV 6	6
Resistance to electrostatic discharge	In open air	kV 8 (level 3)	8 (level 3)
	In direct mode	kV 6 (level 3)	6 (level 3)
Immunity to radiated radio-frequency disturbance		V/m 10 (level 3)	10 (level 3)
Immunity to fast transient currents		kV 2	2
Conducted emissions	Conforming to EN 55011	Class A	Class A
Conducted HF disturbance	Conforming to EN 61000-4-6	V 10	10

Characteristics

Auxiliary contact characteristics

Relay type				LR97 D●●●●●				LT47 ●●●●●				
Contact type				1 NO/NC				1 N/O + 1N/C				
Conventional thermal current				A	3				3			
Maximum hold consumption of controlled contactor coils (occasional operating cycles of contact 95-96)	Conforming to IEC 60947	V	~ 24	~ 48	~ 110	~ 220	~ 24	~ 48	~ 110	~ 220		
		VA	70	140	360	360	70	140	360	360		
		V	--- 24	--- 48	--- 110	--- 220	--- 24	--- 48	--- 110	--- 220		
		W	55	55	28	28	55	55	28	28		
Short-circuit protection		By gG, BS fuses. Maximum rating or GB2 circuit-breaker		A	3				3			
Connection by cable or lug-clamps												
Flexible cable without cable end	1 or 2 conductors	Min.	mm ²	1 x 0.75				1 x 1				
		Max.	mm ²	2 x 2.5				2 x 2.5				
Flexible cable with cable end	1 or 2 conductors	Min.	mm ²	1 x 0.34				1 x 1				
		Max.	mm ²	1 x 1.5 + 1 x 2.5				2 x 2.5				
External Ø of lugs			mm	7				7				
Ø of screw			mm	M3				M3.5				
Tightening torque			N.m	0.6...1.2				0.8...1.7				

Electrical characteristics of power circuit

Relay type				LR97 D015●● to LR97 D25●●	LR97 D38●●	LT47 ●●●●●
Setting range		Depending on model		A	0.3...38	0.5...60
Tripping class					Adjustable	Adjustable
Rated insulation voltage (Ui)	Conforming to IEC 60947-4-1		V	690		690
	Conforming to UL, CSA		V	600		600
Rated impulse withstand voltage (Uimp)			kV	6		6
Frequency limits		Of the operating current		Hz	50...60	
Connection by cable or lug-clamps						
Flexible cable without cable end	1 conductor	Min.	mm ²	1.5	2.5	—
		Max.		10	10	—
Flexible cable with cable end	1 conductor	Min.	mm ²	1	1	—
		Max.		4	6	—
External Ø of lugs			mm	10	12	—
Ø of screw			mm	M4	M4	—
Tightening torque			N.m	2	2	—

Operating characteristics

Relay type			LR97 D●●●●●		LT47 ●●●●S		LT47 ●●●●A		
Adjustment	Current		A	"Load" knob		"Load" knob		"Load" knob	
	Time	D-time knob	s	0.5...30		0.5...30		–	
		O-time knob	s	0.2/0.3...10		0.2/0.3...10		0.2/0.3...30	
		R-time knob	s	–		–		1...120	
Reset	Manual			Reset button		Reset button		Reset button	
	Automatic			120 s fixed		–		R-time knob: 1-120 s	
	Electrical			By interruption of power supply (minimum 0.1 s)		By interruption of power supply (minimum 0.1 s)		By interruption of power supply (minimum 0.1 s)	
Protection functions				On starting	Steady state	On starting	Steady state	–	
Overload $I_{\max} > I_{\text{setting}}$	Tripping			Inhibited during D-time	After O-time	Inhibited during D-time	After O-time	After O-time	
Locked rotor, mechanical jamming $I > 3 \times I_{\text{setting}}$	Tripping			After D-time	< 0.5 s	Inhibited during D-time	After O-time	After O-time	
Sensitivity to phase failure	Tripping			< 3 s	< 3 s	Inhibited during D-time	After O-time	After O-time	
Status and fault signalling (see table page 6/34)				2 LEDs		2 LEDs		2 LEDs	
TEST/STOP function	Test			No load		No load		No load	
	Stop			Under load		Under load		Under load	
Sealing				Yes		Yes		Yes	



LR97 D07●●



LT47 30●●●

LR97 D electronic over current relays

Relay setting range	Usable range (1)	For use with contactor (2)	Relay supply voltage	Reference (3)	Weight
A	A				kg
0.3...1.5	0.3...1.3	LC1 D09...D38	~ 200...240 V	LR97 D015M7	0.172
			~ 100...120 V	LR97 D015F7	0.172
			~/~ 24 V	LR97 D015B	0.172
			~/~ 48 V	LR97 D015E	0.172
1.2...7	1.2...6	LC1 D09...D38	~ 200...240 V	LR97 D07M7	0.172
			~ 100...120 V	LR97 D07F7	0.172
			~/~ 24 V	LR97 D07B	0.172
			~/~ 48 V	LR97 D07E	0.172
5...25	5...21	LC1 D09...D38	~ 200...240 V	LR97 D25M7	0.172
			~ 100...120 V	LR97 D25F7	0.172
			~/~ 24 V	LR97 D25B	0.172
			~/~ 48 V	LR97 D25E	0.172
20...38	20...34	LC1 D25...D38	~ 200...240 V	LR97 D38M7	0.172
			~ 100...120 V	LR97 D38F7	0.172
			~/~ 24 V	LR97 D38B	0.172
			~/~ 48 V	LR97 D38E	0.172

LT47 electronic over current relays

Relay setting range	Usable range (1)	Relay supply voltage	Reference	Weight
A	A			kg
LT47 relay with manual/electric reset				
0.5...6	0.5...5	~ 200...240 V	LT47 06M7S	0.192
		~ 100...120 V	LT47 06F7S	0.192
		~/~ 24 V	LT47 06BS	0.192
		~/~ 48 V	LT47 06ES	0.192
3...30	3...25	~ 200...240 V	LT47 30M7S	0.192
		~ 100...120 V	LT47 30F7S	0.192
		~/~ 24 V	LT47 30BS	0.192
		~/~ 48 V	LT47 30ES	0.192
5...60	5...50	~ 200...240 V	LT47 60M7S	0.192
		~ 100...120 V	LT47 60F7S	0.192
		~/~ 24 V	LT47 60BS	0.192
		~/~ 48 V	LT47 60ES	0.192
LT47 relay with automatic reset				
0.5...6	0.5...5	~ 200...240 V	LT47 06M7A	0.192
		~ 100...120 V	LT47 06F7A	0.192
		~/~ 24 V	LT47 06BA	0.192
		~/~ 48 V	LT47 06EA	0.192
3...30	3...25	~ 200...240 V	LT47 30M7A	0.192
		~ 100...120 V	LT47 30F7A	0.192
		~/~ 24 V	LT47 30BA	0.192
		~/~ 48 V	LT47 30EA	0.192
5...60	5...50	~ 200...240 V	LT47 60M7A	0.192
		~ 100...120 V	LT47 60F7A	0.192
		~/~ 24 V	LT47 60BA	0.192
		~/~ 48 V	LT47 60EA	0.192

Accessories (to be ordered separately)

Description	For use with	Sold in lots of	Unit reference	Weight
				kg
Pre-wiring kits allowing connection of the LR97 D relay N/C contact directly to the contactor	LC1 D09...D18	10	LAD 7C1	0.002
	LC1 D25...D38	10	LAD 7C2	0.003
Terminal block for clip-on mounting on 35 mm rail (AM1 DP200)	LR97 D	1	LAD 7B106	0.100

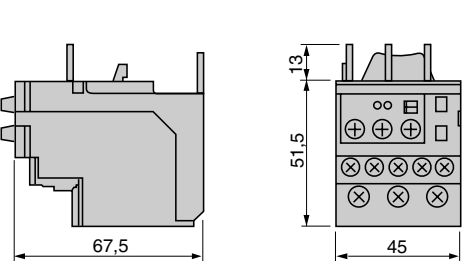
(1) To allow adjustment of the tripping sensitivity, see adjustment method (page 6/34).

(2) Please see pages 5/42 and 5/43.

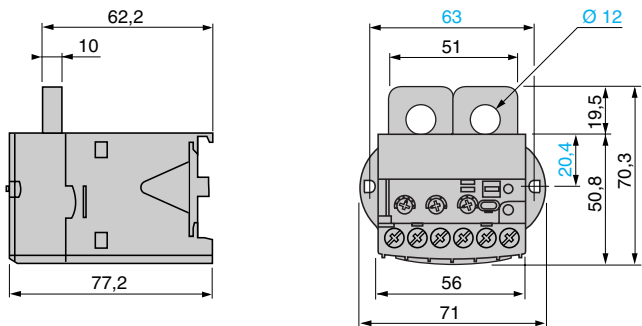
(3) If a pre-wiring kit is used, it is no longer possible to electrically wire signalling of tripped status.

Dimensions

LR97 D●●●●



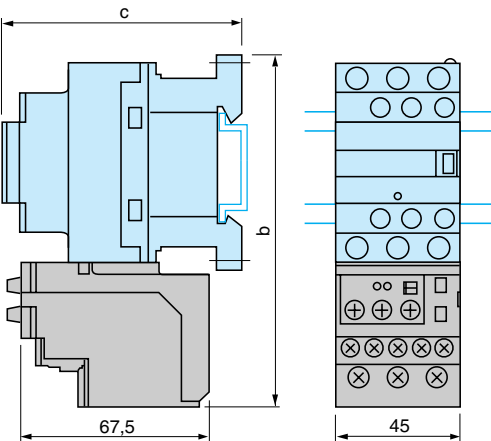
LT47 ●●●●



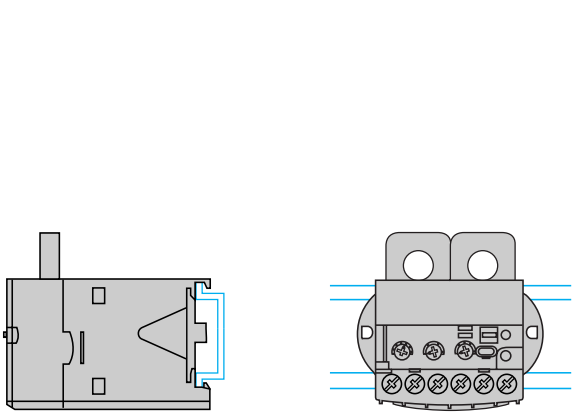
Mounting

LR97 D●●●●

Direct mounting beneath the contactor



LT47 ●●●●

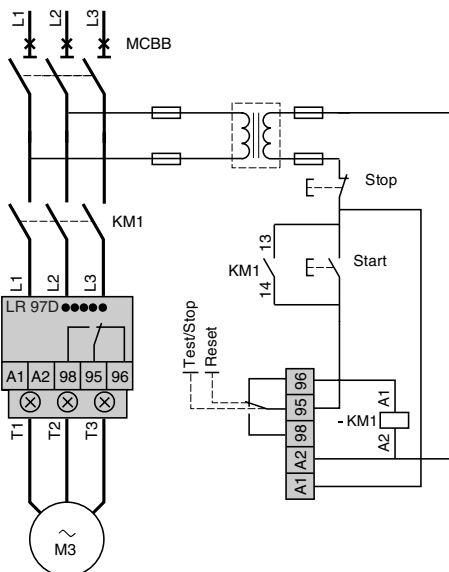


	D09...D18	D25...D38
b	123	137
c	See pages 5/82 and 5/83	

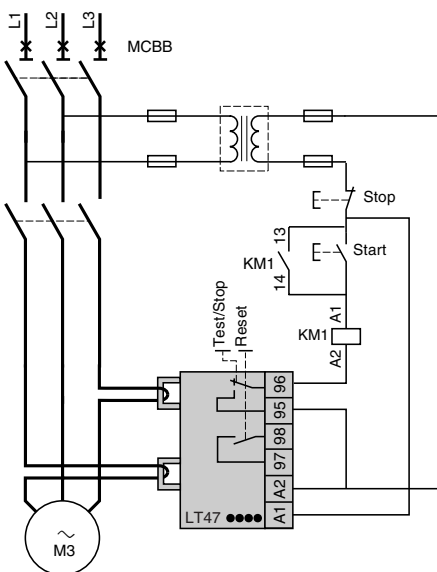
Note: Can be mounted on rail.

Schemes

LR97 D●●●●



LT47 ●●●●





LT6 P0M005FM

The LT6 is a protection relay designed for motor control.

Not using serial link communication

The LT6 protects against:

- thermal overloads, by monitoring the machine currents,
- machine overheating (using PTC probes),
- phase imbalance and phase failure,
- earth fault.

It provides:

- fault signalling via a relay output and a 7 segment display,
- the control of motors (reversing).

Using serial link communication

The LT6 protects against:

- thermal overloads, by monitoring the machine currents,
- machine overheating (using PTC probes),
- phase imbalance and phase failure,
- earth fault,
- no-load running,
- long starting time,
- overtorque and stalled rotor,
- reversal of phase rotation,
- a too low power factor ($\cos \varphi$).

It provides:

- fault and alarm signalling, using a remote display,
- fault signalling via a relay output and a 7 segment display,
- load shedding by monitoring voltage between phases,
- signalling if short-circuit current is exceeded,
- thermal alarm,
- the control of motors (independent, reversing and 2-stage).

It communicates via a bus:

- for receiving configuration parameters for the LT6 (protection, motor control),
- for information exchange with the LT6:
 - instantaneous values (voltage, current per phase, frequency, $\cos \varphi$, thermal state),
 - data log of 5 previous trip incidents (causes and remedies),
 - maintenance statistics, cause of trip statistics,
 - operating and alarm states.

It incorporates a communication watchdog function:

in the event of loss of communication, fallback mode parameters can be set.

Description

On the front panel of the relay:

- a 7 segment display for fault indication,
- a "Test" button which opens the control contacts and closes the fault signalling contacts,
- a trip "Reset" button.
- a DIP switch for selection of:
 - bus communication address,
 - communication protocol (Uni-Telway or Jbus/Modbus),
 - manual or automatic reset following a thermal fault,
 - thermal overload parameter settings from the front panel or via serial link communication (line adjust or local adjust).
- a serial interface (9-way SUB-D) enables RS 232 or RS 485 connection, depending on the user's cabling method,
 - using RS 232 connection, kit reference LA9 P620 enables communication (parameters and indication) between the relay and a PC running under Microsoft Windows 95, 98 or NT 4,
 - using RS 485 connection, the relay is connected to a Uni-Telway or Jbus/Modbus bus,
 - using RS 232 connection enables the relay status to be read at a remote display unit XBT H41101●.

LT6 configuration table

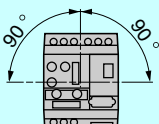
Functions			Setting parameters		
Description	Factory activated	Activated/deactivated by serial link	Description	Initial values	Adjustment range accessible via serial link communication
Thermal overload: thermal protection of motor by monitoring current consumption		—	I _r (% rating) Class Overload alarm	20 % 5 100 %	20...109 % (1) 5...30 (1) 0...125 %
Overheating (PTC): thermal monitoring of motor using built-in PTC temperature probes			—	—	—
Phase imbalance and phase failure: monitors symmetry of rms current values			I _d (% of I _{rms} average) (2) Time before tripping	30 % of I average 0.7 s (starting) 5 s (running)	10...30 % 0...10 s 0...10 s
Earth fault (DDR): monitors insulation faults using toroid sensor			I _{Dn} Time before tripping	30 A 5 s	0.3...30 A 0...5 s
Long starting time: LT6 trips if both I _{sd} and preset time exceeded	—		I _{sd} (% of I _r) Starting time	150 % I _r 10 s	100...500 % I _r 0...30 s
No-load running: LT6 trips if both I _v and preset time exceeded	—		I _v (% of I _r) Time before tripping	30 % I _r 10 s	30...90 % I _r 0...30 s
Torque limitation: LT6 trips if both I _{lc} and preset time exceeded. Function inactive during starting	—		I _{lc} (% of I _r) Time before tripping	200 % I _r 10 s	150...800 % I _r 0...30 s
Cos φ : monitors phase shift between motor current and voltage	—		Cos φ Time before tripping	0.1 10 s	- 1...1 0...10 s
Monitoring of rotational direction of phases	—		—	Forward running	—
Load shedding: opens channels A and B of LT6 if voltage drops below preset value	—		Shedding Time before shedding Re-establishment Time before re-establishment	70 % U _n 10 000 s 90 % U _n 10 000 s	68...120 % U _n 0...100 000 s 68...120 % U _n 0...100 000 s
Short-circuit detection: signals short-circuit condition via the serial interface		—	I _{sc}	15 x I _r peak	—
Reset: effective after programmable time or when the thermal state drops below a programmed value		—	Time before reset θ °C (iron) before reset	0 s 100 % θ _n	0...1000 s 40...100 % θ _n
Motor control		—	Control of outputs A and B	Reversing	Reversing, independent 2-stage
Self-cooled/Auto-cooled		—	—	Self-cooled	Self-cooled or auto-cooled
Communication watchdog	—		Opening of outputs A and B, in the event of loss of communication	—	—

(1) These values can be activated and adjusted from the front panel of the relay when set to "Local adjust".

(2) The average rms current is equal to the average current value of the 3 phases.

Factory activated functions or functions activated/deactivated by serial link communication.

Environment

Conforming to standards		IEC 600947-4-1, IEC 60034-11, IEC 60755, VDE 0106, VDE 0660	
CE marking		Meets the essential requirements of European Low Voltage and EMC Directives	
Product certifications		UL 508, CSA, RINA, LROS	
Protective treatment		"TH"	
Degree of protection	Conforming to IEC 60947-1	IP 20 (1)	
Shock resistance	Conforming to IEC 6068-2-27	15 gn, 11 ms	
Vibration resistance	Conforming to IEC 6068-2-6	2 gn from 3 to 100 Hz	
Ambient air temperature around the device	Storage	°C	- 35...+ 85
	Operation	°C	- 20...+ 70
Flame resistance	Conforming to UL 94	V0	
Maximum operating altitude		m	2000
Operating position	In relation to normal vertical mounting plane		
Resistance to electrostatic discharge	Conforming to IEC 61000-4-2, level 3	kV	8
Resistance to radiated electromagnetic interference	Conforming to IEC 61000-4-3, level 3	V/m	10
Resistance to fast transient currents	Conforming to IEC 61000-4-4, level 4	kV	2
Resistance to conducted radio-frequency disturbance			Conforming to IEC 61000-4-6, level 3
Non-dissipating shock wave (U imp)	Conforming to IEC 60947-1	kV	6
Dissipated shock wave			Conforming to IEC 61000-4-5, level 3
Supply harmonics			Conforming to IEC 60947-2 appendix F
Resistance to micro-breaks			Conforming to IEC 61000-4-11

(1) Only applicable when power cabling to relay exceeds the following sizes:
1.5 mm² with cable end or 2.5 mm² without cable end.

Power circuit characteristics				
Relay type			LT6 P0M005FM	LT6 P0M025FM
Rated insulation voltage (U _i)	Conforming to IEC 60947-1	V	~ 690	~ 690
Operating frequency		Hz	50/60	50/60
Rated operational current		A	1 or 5 (1)	25
Input impedance		Ω	< 0.1	< 0.1
Connection				
	Solid cable	1 or 2 conductors	mm ²	1.5...6
	Flexible cable without cable end	1 or 2 conductors	mm ²	1.5...6
	Flexible cable with cable end	1 or 2 conductors	mm ²	1.5...4
Tightening torque		N.m	1.7	
Associated protection				
By circuit-breaker	Operational current ≤ 25 A		≤ GV2 L05 (1 A relay rating) ≤ GV2 L10 (5 A relay rating)	≤ GV2 L22
			Compact NS●●●●MA (Merlin Gerin)	
	Operational current > 25 A (using a current transformer)			
		By fuses	Operational current ≤ 25 A	A
Operational current > 25 A (using a current transformer)			≥ 32 (aM), ≥ 63 (gG, gM)	
Control circuit supply characteristics				
Rated insulation voltage (U _i)	Conforming to IEC 60947-1	V	~ 380	
Operating voltage		V	--- or ~ 50/60 Hz: 90...276	
Power consumption	50/60 Hz	VA	15	
	---	W	7	
Cabling				
	Solid cable	Plug-in connector 1 or 2 conductors	mm ²	0.5...1
	Flexible cable without cable end	1 or 2 conductors	mm ²	0.5...1
	Flexible cable with cable end	1 conductor	mm ²	0.5...1
		2 conductors	mm ²	0.5...0.75
Tightening torque		N.m	0.7	
Discrete input characteristics				
Rated insulation voltage (U _i)	Conforming to IEC 60947-1	V	~ 250	
Operating voltage		V	--- 90...150. ~ 90...276	
Current consumption	Minimum transient value	mA	≥ 1 (changing from state 0 to state 1 in t ≥ 4 ms)	
Power consumption		W	0.5	
Input impedance		kΩ	56	

(1) Using external current transformer for operating currents exceeding 25 A: see page 6/48.

Communication interface characteristics

Physical interface		RS 232: connection to PC or XBT H RS 485: connection to programmable controller
Connector on LT6		9-way SUB-D
Maximum transmission speed	bit/s	9600
Minimum time between 2 requests	m/s	100

Discrete output characteristics

Rated insulation voltage (Ui)	Conforming to IEC 60947-1	V	~ 380
Output type	Relay interface		1 N/O per channel
Associated fuse protection	Conforming to IEC 60947-5	A	6 (type gC)
a.c. loads			
Rated voltage		V	~ 250
Permissible power for category AC-15 Associated with contactor		VA	500 (Ie = 0.5 A, Ue = ~ 250 V, Ith = 5 A, cos φ = 0.4 for 100 000 operations) LC1 K, LC2 K, LC7 K, LC8 K, LC1 D09 to D150
d.c. loads			
Rated voltage		V	--- 30
Permissible power for category DC-15 Associated with contactor		W	50 (Ie = 0.5 A, Ue = --- 250 V, Ith = 5 A, L/R ≤ 25 ms for 100 000 operations) LP1 K, LP2 K, LP1 D09 and D12 LC1 D09 to D38 --- LC1 D40 to D95 (with LA4 DC3U)

Signalling output characteristics

Rated insulation voltage (Ui)	Conforming to IEC 60947-1	V	~ 380
Output type	Relay interface	V	1 N/O per channel
Associated fuse protection	Conforming to IEC 60947-5	A	2 (type gC)
Current limit	At U = --- 5 V	mA	10
a.c. loads			
Rated voltage		V	~ 250
Permissible power for category AC-15 Associated with contactor		VA	250 (Ie = 0.2 A, Ue = ~ 250 V, Ith = 2 A, 300 000 operations on a resistive load) LC1 K, LC2 K, LC7 K, LC8 K with suppressor module LA4 KE
d.c. loads			
Rated voltage		V	--- 30
Permissible power for category DC-15 Associated with contactor		W	50 (Ie = 0.2 A, Ue = --- 30 V, Ith = 2 A, 300 000 operations on a resistive load) LP1 K, LP2 K with suppressor module LA4 KC

LT6 CT●●●● external current transformer characteristics

Conforming to standards		IEC 60185, BS 7626			
Precision		Class 5P			
Precision limit factor		15			
Rated insulation voltage (U _i)	V	690			
Maximum operating temperature	°C	50			
Transformer ratio	A	100/1	200/1	400/1	800/1
Diameter of conductor passage hole	mm	35	35	35	10
Maximum cabling c.s.a.	mm ²	300	300	300	Incorporated (1)

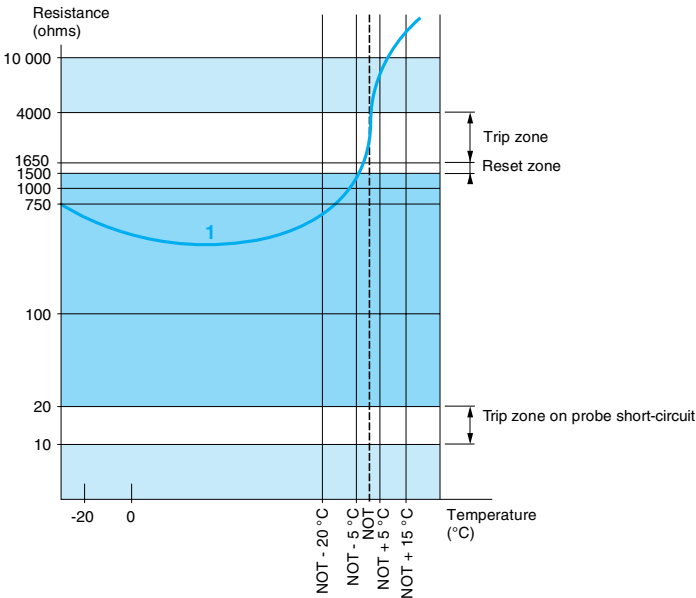
XBT H41101● display module characteristics

Supply		V	--- 24
Display	Type		LCD, 9 mm
	Capacity		2 lines of 20 characters
	Input keys		2
	Pilot lights		LED, communication LED, acknowledgement of input key operation
Operating temperature		°C	0...+ 50
Storage temperature		°C	- 20...+ 70
Humidity (without condensation)		%	0...85
Protection	Front panel		IP 65 (IEC 60529, NF C 20-010, UL)
	Rear panel		IP 20
Resistance to electrostatic discharge	IEC 61000-4-2		Level 3
Electromagnetic interference	IEC 61000-4-3	V/m	10
Electrical interference	IEC 61000-4-4		Level 3
Shock resistance	IEC 60068-2-27		30 gn, 11 ms, 1/2 sine
Vibration resistance	IEC 60068-2-6		0.075 mm from 2 to 57 Hz 1 gn from 57 to 150 Hz
Communication with the LT6			Serial link type using specific cable XBT Z9701 (see page 6/48)
Software	Modbus protocol		Loaded as standard and available in 3 languages

(1) Electrical connection to be made using M10 bolt.

Probe characteristics			
Probe type		DA1 TT●●●	
Conforming to standards		IEC 60034-11 mark A	
Resistance	At 25 °C	Ω	3 x 250 in series
Rated operational voltage (Ue)	Per probe	V	--- 2.5 max
Rated insulation voltage (Ui)		kV	2.5
Insulation		Reinforced	
Length of connecting cables	Between probes	mm	250
	Between probe and motor terminal plate	m	1

Guaranteed operating zones: example with 3 probes type DA1 TT●●● (250 Ω at 25 °C) in series, conforming to standard EC 60034-11, mark A.

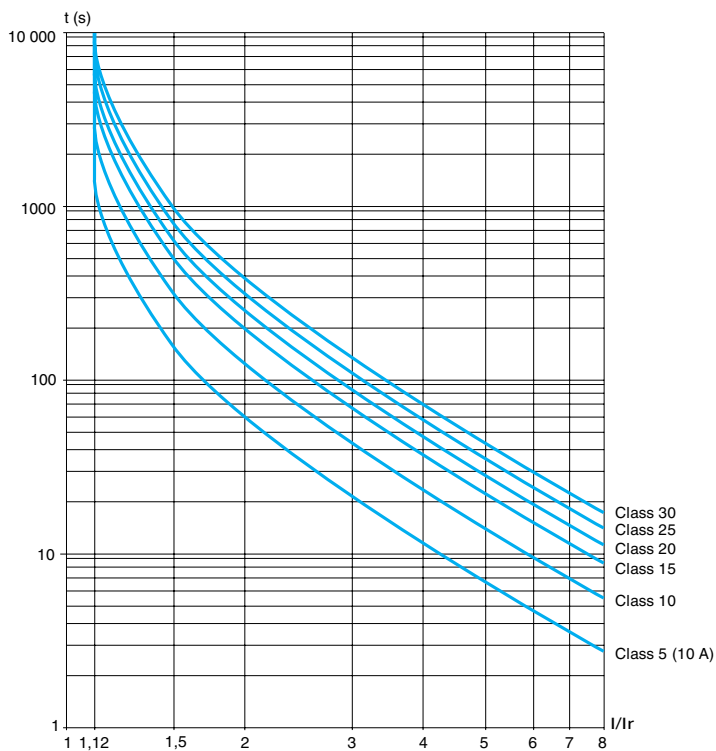


1 3 probes type DA1 TT●●● (250 Ω to 25 °C) in series.

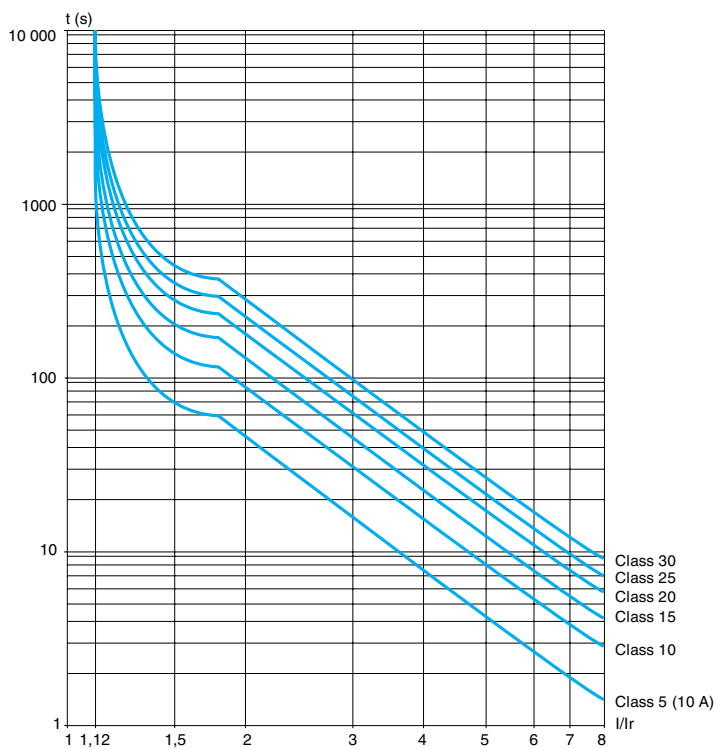
NOT: Nominal Operating Temperature

- Protection unit tripped.
- Protection unit reset.

Cold state curves (1)



Hot state curves (1)



(1) Tripping time accuracy: $\pm 8\%$ at $7.2 \times I/I_r$.

Protection components

Multifunction protection relays LT6 P



LT6 P0M005FM



LT6 CT4001

3-pole multifunction protection relays

Operational current (1) A	Description	Weight kg
0.2...1	LT6 P0M005FM	1.030
1...5		
5...25	LT6 P0M025FM	1.030

Configuration software

Description	Languages	For use with	Reference	Weight kg
Kit comprising: - two 3" 1/2 diskettes, (for Windows 2000 XP 95, 98, NT 4), - 2 m connection cable fitted at each end with a 9-way SUB-D connector (female-female)	English, French, German, Italian, Spanish	All relay ratings	LA9 P620	0.550

Current transformers

Operational current		Reference	Weight
Primary	Secondary		kg
A	A		
100	1	LT6 CT1001	0.550
200	1	LT6 CT2001	0.550
400	1	LT6 CT4001	0.550
800	1	LT6 CT8001	0.680

Display modules

Language	Supply voltage V	Reference	Weight kg
French	— 24	XBT H411011	0.620
English	— 24	XBT H411013	0.620
Spanish	— 24	XBT H411014	0.620

Connection cable

Function	Reference	Weight kg
Ensures connection link between the LT6 relay and display modules XBT H/P/E/HM/PM. Comprising a 9-way SUB-D female connector and a 25-way SUB-D male connector (length 2.2 m)	XBT Z9701	0.200

(1) For operational currents greater than 25 A, use an external current transformer with a 1 A or 5 A secondary.



DA1 TT●●●

Earth fault toroids

Products marketed under the Merlin Gerin brand

Sensitivity	Internal Ø of toroid	Reference	Weight
A	mm		kg
0.3...30	30	TA30	0.120
	46	POA	1.300
	50	PA50	0.200
	80	IA80	0.420
	110	GOA	3.200
	120	MA120	0.530
	200	SA200	1.320
	300	GA300	2.230

PTC thermistor probes (1)

Description	Nominal Operating Temperature (NOT)	Sold in lots of	Unit reference	Weight
	°C			kg
Triple probes	90	10	DA1 TT090	0.010
	110	10	DA1 TT110	0.010
	120	10	DA1 TT120	0.010
	130	10	DA1 TT130	0.010
	140	10	DA1 TT140	0.010
	150	10	DA1 TT150	0.010
	160	10	DA1 TT160	0.010
	170	10	DA1 TT170	0.010

Marking accessories (to be ordered separately)

Description	Composition	Sold in lots of	Unit reference	Weight
				kg
Clip-in markers (maximum of 5 per relay)	Strips of 10 identical numbers (0 to 9)	25	AB1 R● (2)	0.002
	Strips of 10 identical capital letters (A to Z)	25	AB1 G● (2)	0.002

Replacement part

Description	Reference	Weight
		kg
Set of plug-in connectors (3)	LA9 P600	0.150

(1) PTC: Positive Temperature Coefficient.

(2) When ordering, replace the ● in the reference with the number or letter required.

(3) The set includes upstream, downstream and probe-entry connectors.

Protection components

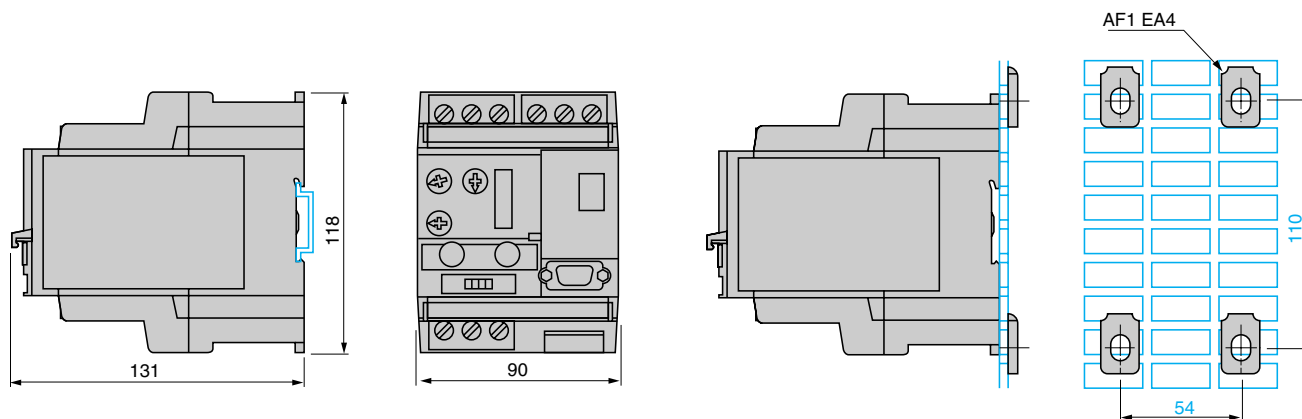
Multifunction protection relays LT6 P

Protection relays LT6 P

LT6 P0M●●●FM

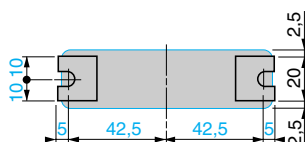
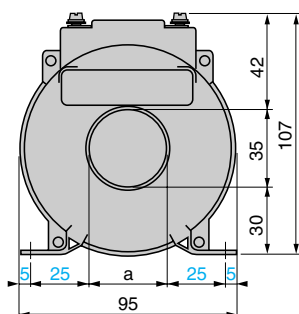
On 35 mm mounting rail

On pre-slotted mounting plate AM1 PA



Current transformers

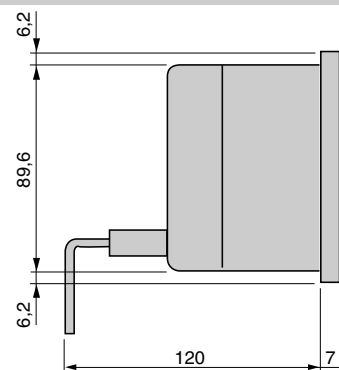
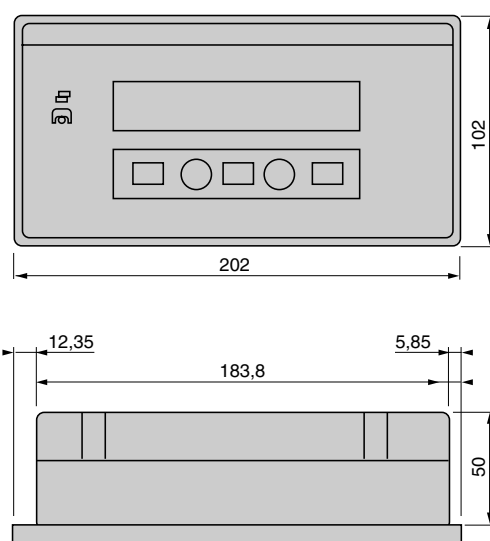
LT6 CT



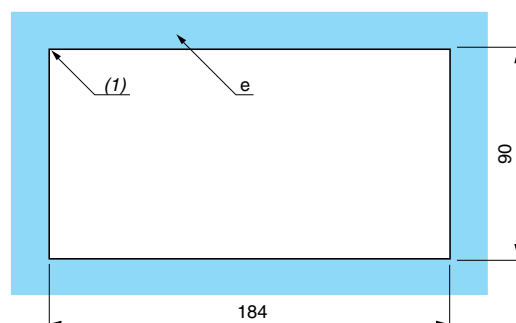
LT6	a
CT1001	35
CT2001	35
CT4001	35
CT8001	10

Display modules

XBT H41101●



Panel cut-out

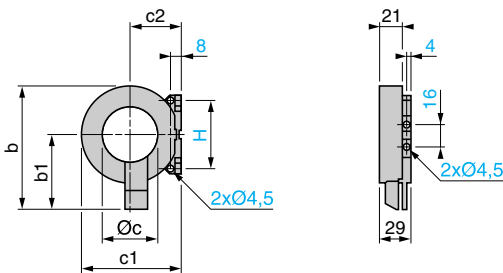


Support panel thickness $e = 1.5 \dots 6 \text{ mm}$.

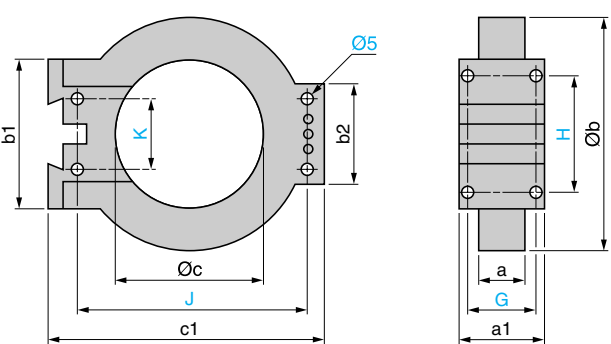
(1) *R*: 3.5 max / 2 min.

Earth fault toroids

TA30, PA50



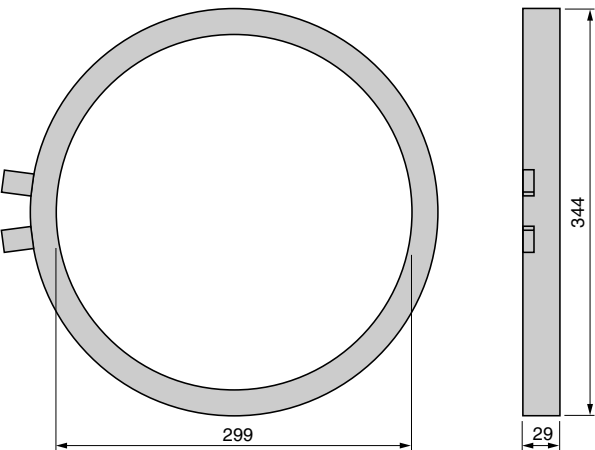
IA80, MA120, SA200



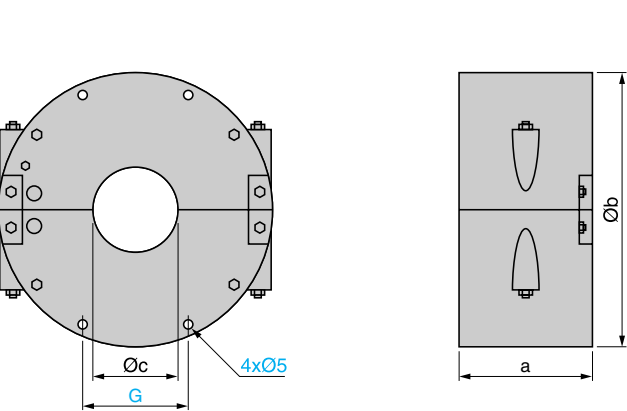
Type	b	b1	Øc	c1	c2	H
TA30	83	53	30	60	31	50
PA50	109	66	50	87	45	60

Type	a	a1	Øb	b1	b2	Øc	c1	G	H	J	K
IA80	26,5	44	122	80	55	80	150	35	65	126	40
MA120	26,5	44	164	80	55	120	190	35	65	166	40
SA200	29	46	256	120	90	196	274	37	104	254	60

GA300



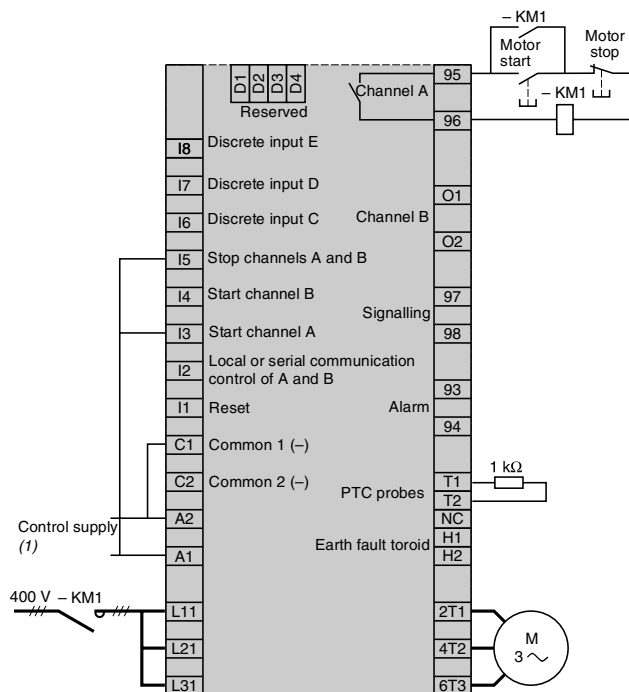
POA, GOA



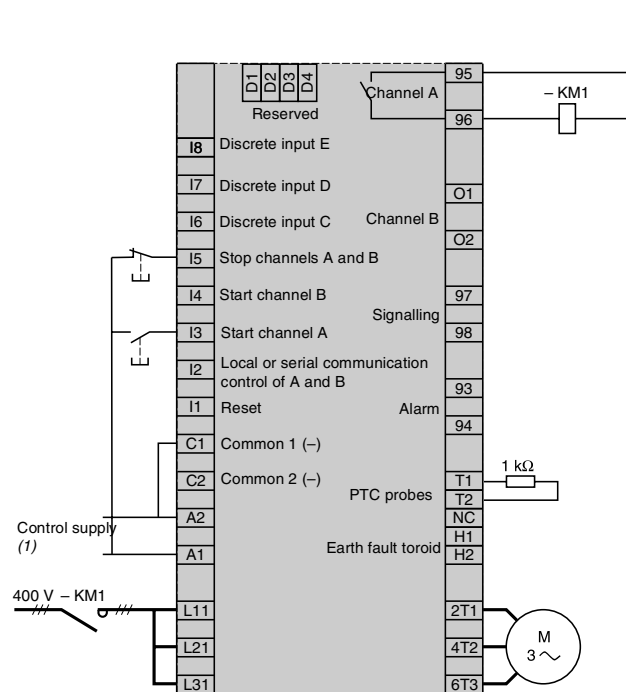
Type	a	Øb	Øc	G
GOA	72	148	46	57
POA	78	224	110	76

Motor control: D.O.L. starting (channels A and B set for reversing or independent control)

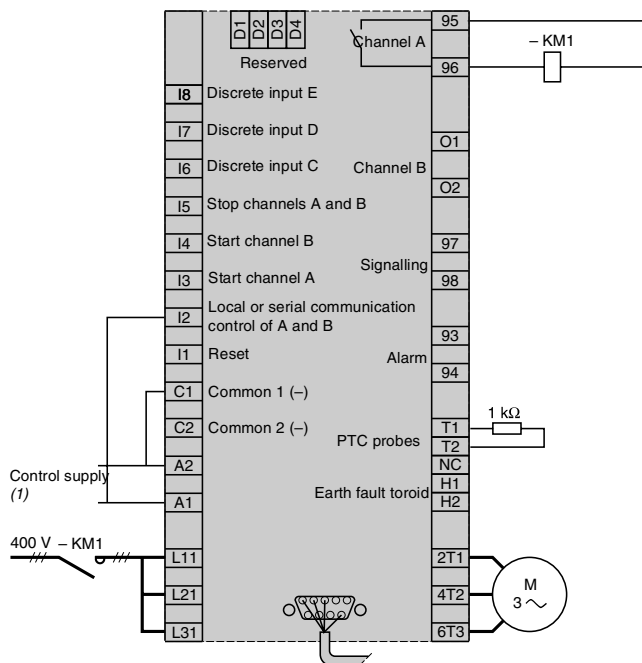
Control from front panel of relay



Control via discrete inputs of relay



Control via serial link communication (Uni-Telway or Jbus/Modbus)



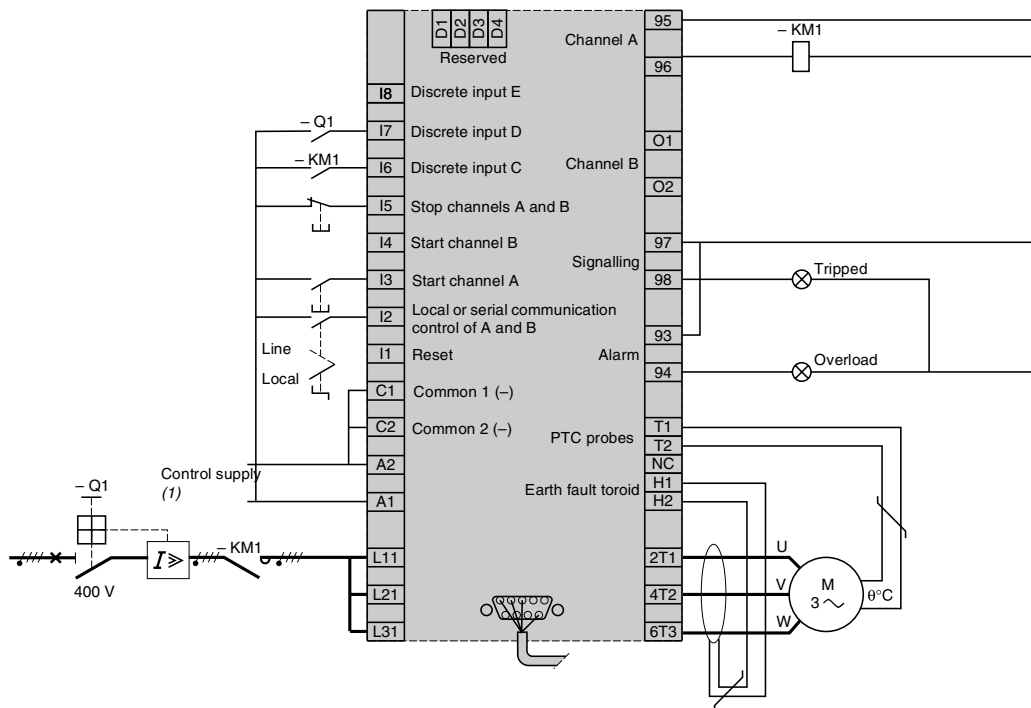
(1) For d.c. supplies, inputs I1 to I8 must be connected to the positive line.

Motor control: D.O.L. starting

Control via serial link communication with signalling, earth fault toroid, PTC probes, state of power components

Channels A and B set for reversing or independent control.

Possible to control the motor via discrete input ("local" position) or by serial link communication

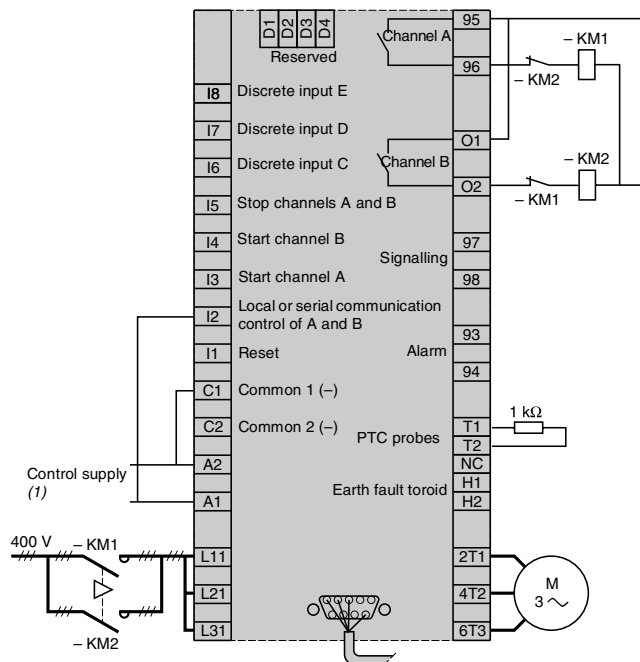


(1) For d.c. supplies inputs I1 to I8 must be connected to the positive line.

Motor control: reverser starting

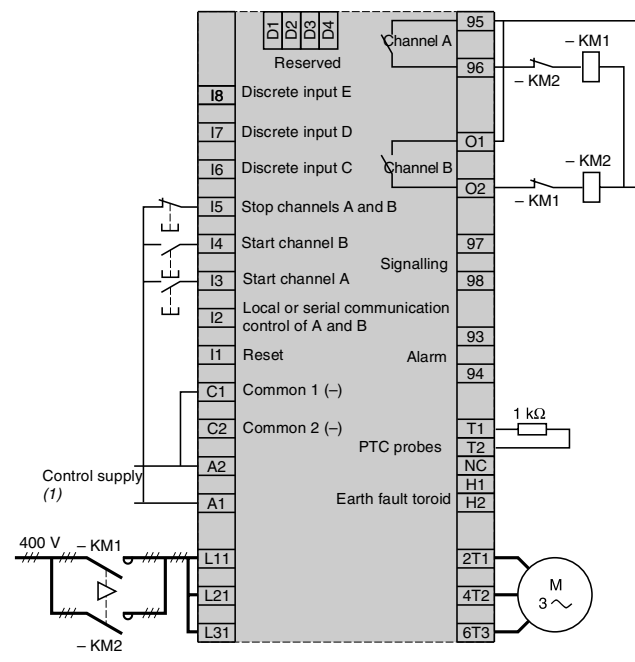
Control via serial link communication

Channels A and B set for reversing control.



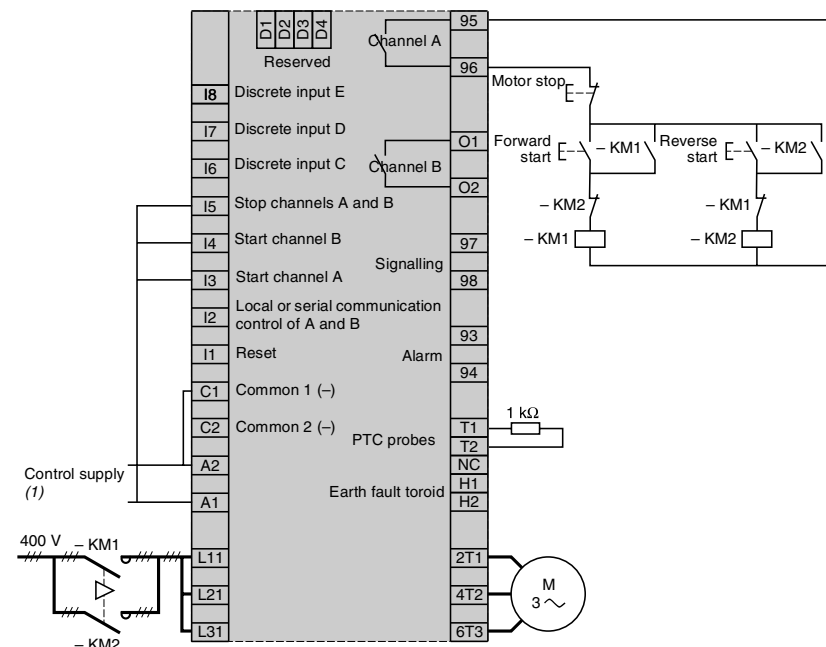
Control via discrete inputs of relay

Channels A and B set for reversing control.



Control from front panel of relay

Channels A and B set for independent control.

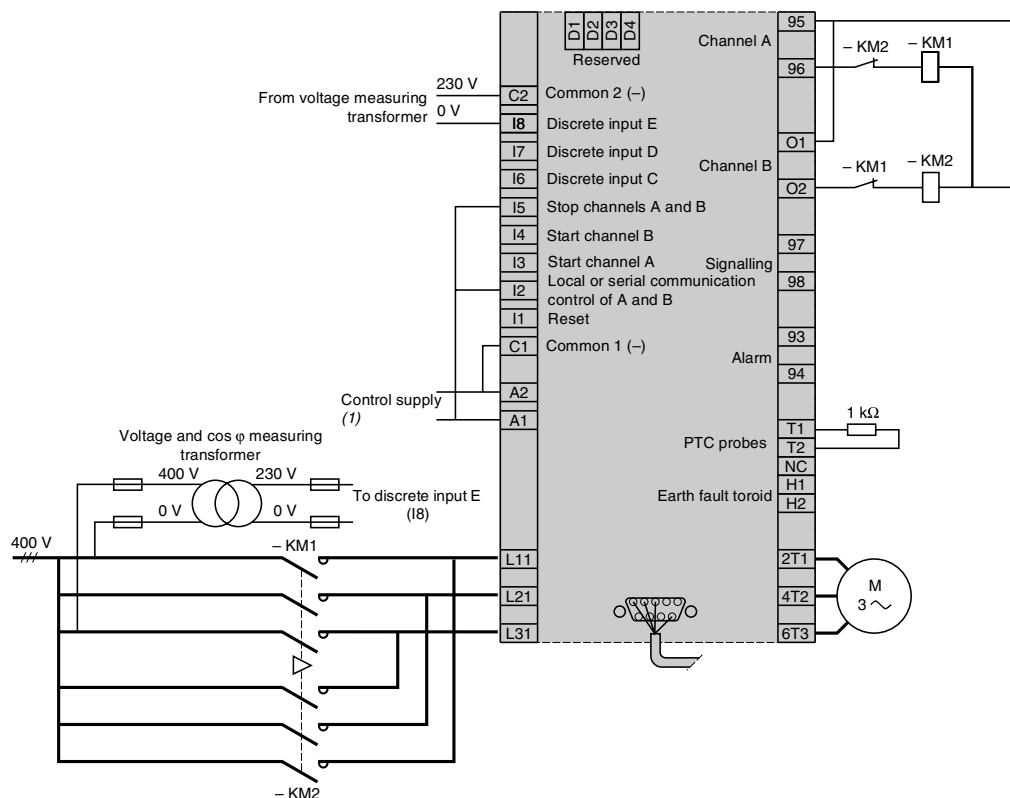


(1) For d.c. supplies inputs I1 to I8 must be connected to the positive line.

Motor control: reverser starting with measurement of $\cos \varphi$ and voltage

Control via serial link communication

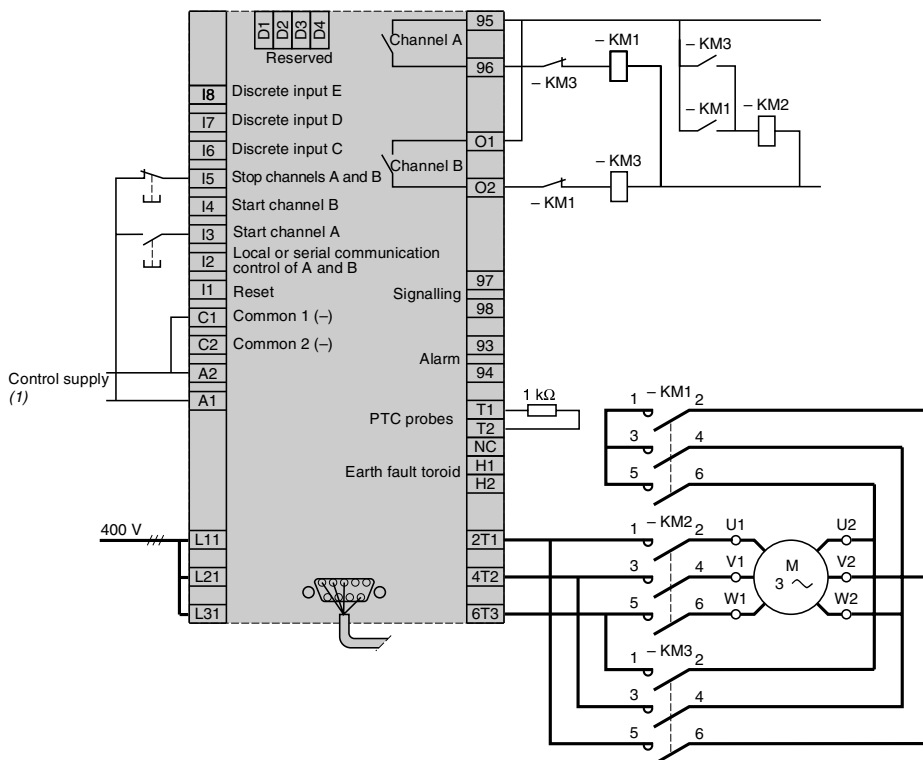
Channels A and B set for reversing control.



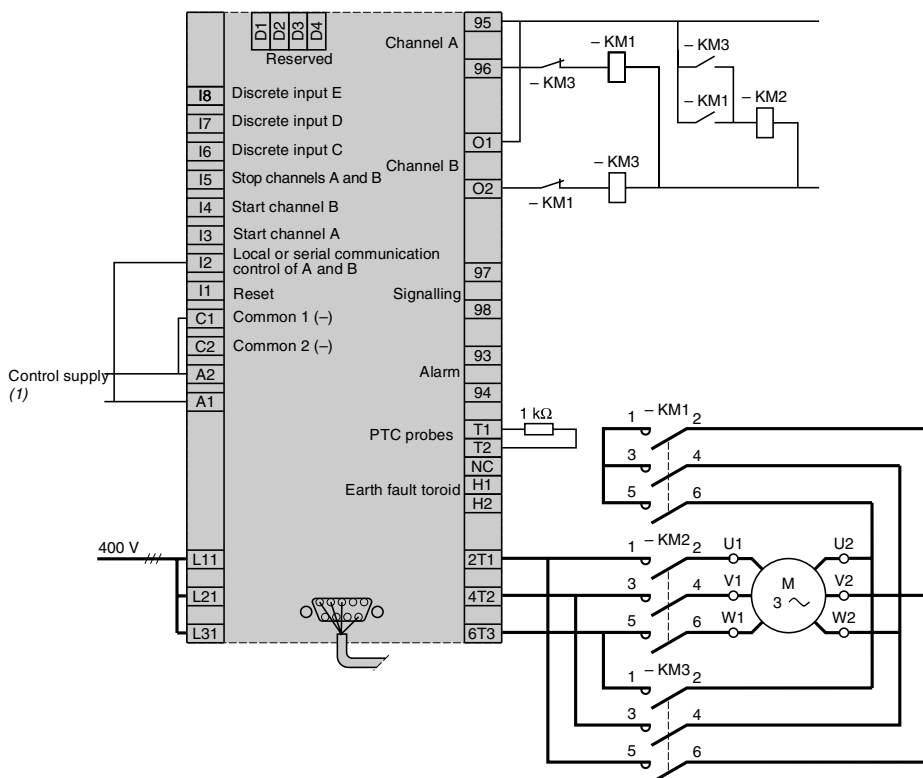
(1) For d.c. supplies inputs I1 to I8 must be connected to the positive line.

Motor control: star-delta starting (channels A and B set for 2-stage control)

Control via discrete inputs of relay



Control via serial link communication

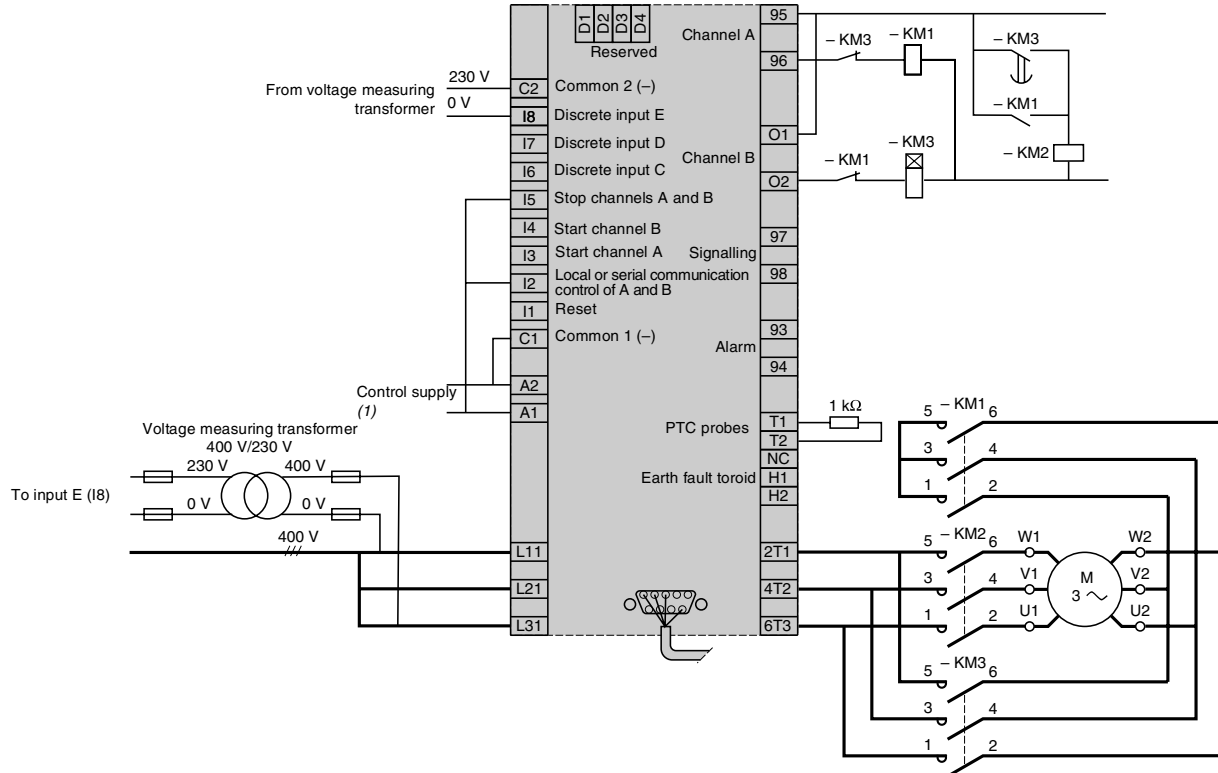


(1) For d.c. supplies inputs I1 to I8 must be connected to the positive line.

Motor control: star-delta starting with adjustable time delay

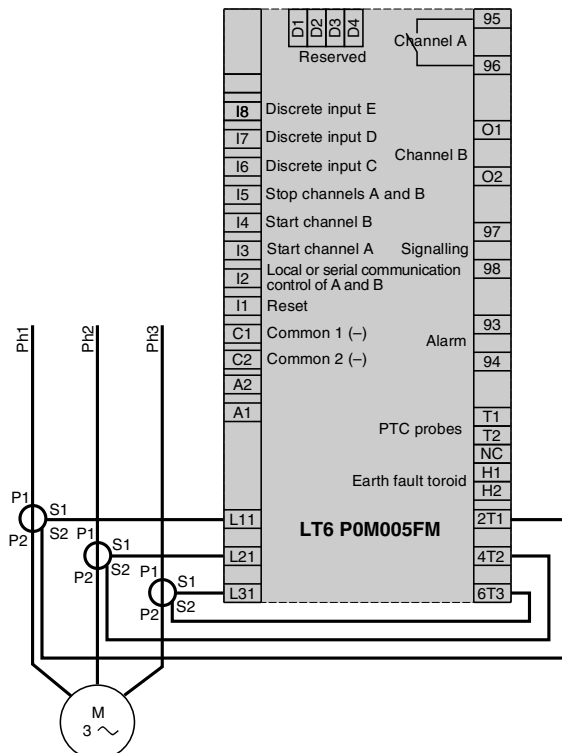
Control via serial link communication

Channels A and B set for 2-stage control.

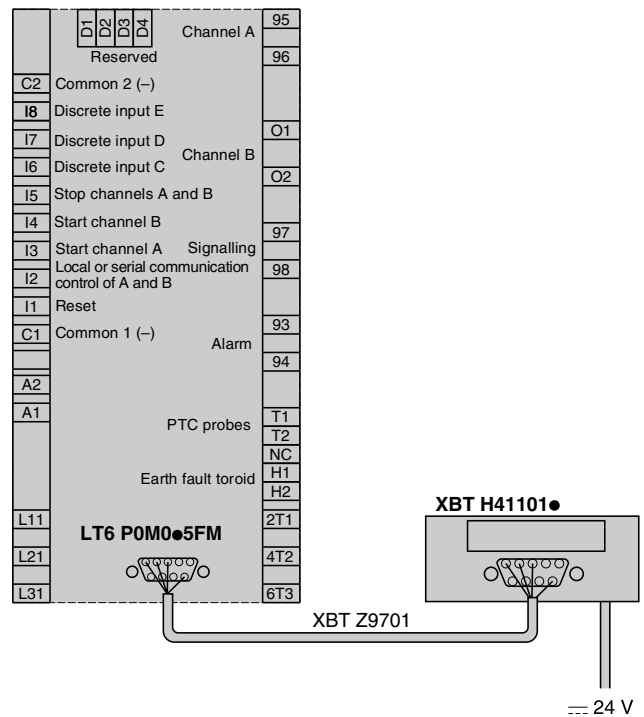


(1) For d.c. supplies the inputs I1 to I8 must be connected to the positive line.

LT6 P0M005FM connections with current transformers LT6 CT●●●●



LT6 P0M0●5FM connections with display module XBT H41101●



Protection components
Thermistor protection units
for use with PTC thermistor probes ⁽¹⁾

Applications

General protection and protection of motors fitted with PTC thermistor probes ⁽¹⁾



Standards and approvals

IEC 60034-11, UL, CSA

Reset method

Automatic

Fault signalling

–

Fault memory in the event of a supply failure

–

Fault test

–

Rated control circuit voltages
~ 50/60 Hz

Single voltage 115 V or 230 V

Rated control circuit voltages ≡

Single voltage 24 V

Contact type

1 N/C

Protection unit type

LT3 SE

Pages

6/64
⁽¹⁾ PTC: Positive Temperature Coefficient



IEC 60034-11, PTB, UL, CSA Marine: BV, LROS, GL, DNV, RINA	
Automatic	Manual or automatic
On front panel of unit and remote	
—	Yes
—	By pushbutton on front panel of unit
Dual voltage 115/230 V Multivoltage 24...230 V	Single voltage 400 V Dual voltage 24/48 V, 115/230 V Multivoltage 24...230 V
Dual voltage 24/48 V	Dual voltage 24/48 V Multivoltage 24...230 V
Dual voltage 1 N/C + 1 N/O Multivoltage 2 C/O	Single voltage or dual voltage 1 N/C + 1 N/O Multivoltage 2 C/O
LT3 SA	LT3 SM
6/64	

Protection components

Thermistor protection units

for use with PTC thermistor probes ⁽¹⁾

Application

LT3 S● thermistor protection units continuously monitor the temperature of the machines to be protected (motors, generators, etc.) by means of PTC thermistor probes embedded in the machine windings.

If the nominal operating temperature of the probes is reached, they convert the rapid increase in resistance into a switching function which can be used to switch off the machine or signal a fault (see paragraph relating to thermistor probes below).

Accidental breaks in the supply circuits of the thermistors are also detected.

Electromagnetic compatibility

Conforming to "Electromagnetic compatibility" directive.
Conforming to standard EN 61000-6-2.

Resistance to electrostatic discharge (conforming to IEC 61000-4-2)	Level 3
Resistance to fast transients (conforming to IEC 61000-4-4)	Level 3
Susceptibility to electromagnetic fields (conforming to IEC 61000-4-3)	Level 3
Surge resistance 1.2/50 - 8/20 (conforming to IEC 61000-4.5)	Level 4
Immunity to microbreaks and voltage drops (IEC 61000-4-11)	
Suitable for use with variable speed controllers	

Thermistor probes

Range of most commonly used PTC thermistor probes:
from 90 to 160 °C, in steps of 10 °C.
Curve $R = f(\theta)$, characteristic of a PTC thermistor probe, is defined by standard IEC 60947-8.

The choice of PTC thermistor probe to be incorporated in the motor winding depends on the insulation class, the type of motor and the most suitable location for the probe. This choice is usually made by the motor manufacturer or the motor rewinder, who have all the necessary information.

Application example

Insulation class of rotating machines conforming to IEC 60034-11 (S1 duty)	NOT Nominal operating temperature	Temperature at which rapid increase in resistance occurs Probes used for	
	°C	Alarm	Fault
		°C	°C
A	100	100	100
B	110	110	120
E	120	120	130
F	140	140	150
H	160	160	170

(1) PTC: Positive Temperature Coefficient

Protection components

Thermistor protection units
for use with PTC thermistor probes ⁽¹⁾

Protection unit type			LT3 SE	LT3 SA	LT3 SM	
Reset method				Automatic	Automatic	Manual/Automatic
Fault indication				–	On front panel of unit and remote	On front panel of unit and remote
Fault test				–	–	By pushbutton on front panel of unit
Probe interchangeability				Label “Mark A” to IEC 60034-11	Label “Mark A” to IEC 60034-11	Label “Mark A” to IEC 60034-11
Environment						
Conforming to standards				IEC 60034-11 VDE 0660	IEC 60034-11 VDE 0660	IEC 60034-11 VDE 0660
Product certifications				–	LROS	
Degree of protection				IP 20 conforming to IEC 60529, VDE 0106		
CE marking				LT3 S● protection units have been designed to comply with the basic recommendations of European directives relating to low voltage and EMC. Therefore LT3 S● products bear the European Community CE mark.		
Ambient air temperature around the device	Storage Conforming to IEC 60068-2-1 and 2-2	°C	- 40...+ 85			
	Operation	°C	- 25...+ 60			
Maximum operating altitude	Without derating		1500 m			
	With derating		Up to 3000 m, the maximum permissible ambient air temperature for operation (60 °C) must be reduced by 5 °C per additional 500 m above 1500 m			
Vibration resistance	Conforming to IEC 60068-2-6		2.5 gn (2...25 Hz) 1 gn (25...150 Hz)			
Shock resistance	Conforming to IEC 60068-2-27		5 gn (11 ms)			
Operating positions without derating	In relation to normal vertical mounting plane		Any position			
Power supply circuit characteristics						
Rated control circuit voltage (Uc)	~ 50/60 Hz	Single voltage	V	115 or 230	–	400
	0.85...1.1 Uc	Dual voltage	V	–	115/230	115/230, 24/48
	~ 50/60 Hz	Multivoltage	V	–	24...230	24...230
	0.85...1.1 Uc					
	---	Single voltage	V	24	–	–
	0.8...1.25 Uc	Dual voltage	V	–	24/48	24/48
	0.85...1.1 Uc	Multivoltage	V	–	24...230	24...230
Average consumption	Sealed	~	VA	< 2.5	< 2.5	< 2.5 except (400 V : 2.7)
		---	W	< 1	< 1	< 1

(1) PTC: Positive Temperature Coefficient

Control circuit characteristics

Protection unit type			LT3 SE	LT3 SA	LT3 SM
Resistance	Tripping	Ω	2700...3100	2700...3100	2700...3100
	Reset	Ω	1500...1650	1500...1650	1500...1650
Maximum number of probes fitted in series ⁽²⁾	Probes ≤ 250 Ω at 25°		6	6	6
Voltage at terminals in the thermistor circuit	Normal operation (R = 1500 Ω)	V	< 2.5	< 2.5	< 2.5
	Conforming to IEC 60034-11 (R = 4000 Ω)	V	< 7.5	< 7.5	< 7.5
Thermistor probe short-circuit detection	Operating threshold	Ω	—	< 20	< 20
Connection of probes to the LT3	Distance	m	300	400	500
	Minimum c.s.a. of conductors	mm ²	0.75	1	1.5
					1000 ⁽³⁾
					2.5

Electrical characteristics of the output relay contacts

Contact type	Single voltage or dual voltage		1 N/C	1 N/C + 1 N/O	1 N/C + 1 N/O
	Multivoltage		—	2 C/O	2 C/O
Rated insulation voltage		V	~ 500		
Maximum operational voltage		V	~ 250 (~ 400 V for LT3 SM00V)		
Rated impulse withstand voltage	Uimp	kV	2.5		
Conventional thermal current		A	5		
Operational power	At 220 V	VA	100 for 0.5 million operating cycles		
Breaking capacity	In cat. AC-16 120 V	A	6		
	250 V	A	3		
	In DC-13 24 V	A	2		
Cabling (cage type connector) for flexible or solid cable	Without cable end	mm ²	2 x 1...1 x 2.5		
	With cable end	mm ²	1 x 0.75...2 x 2.5		
Tightening torque		N.m	0.8		

Thermistor probe characteristics

Probe type			DA1 TT●●●	DA1 TS●●●
Conforming to standards			IEC 60034-11. Mark A	
Resistance	At 25 °C	Ω	3 x 250 in series	250
Rated operational voltage (U _e)	Per probe	V	--- 2.5 V max	--- 2.5 V max
Rated insulation voltage (U _i)		kV	2.5	1
Insulation			Reinforced	Reinforced
Length of connecting cables	Between probes	mm	250	—
	Between probe and motor terminal plate	m	1	1

⁽¹⁾ PTC: Positive Temperature Coefficient

⁽²⁾ Provided that the total resistance of the probe circuit is less than 1500 Ω at 20 °C.

⁽³⁾ For distances greater than 500 m take cabling precautions (twisted shielded pairs).

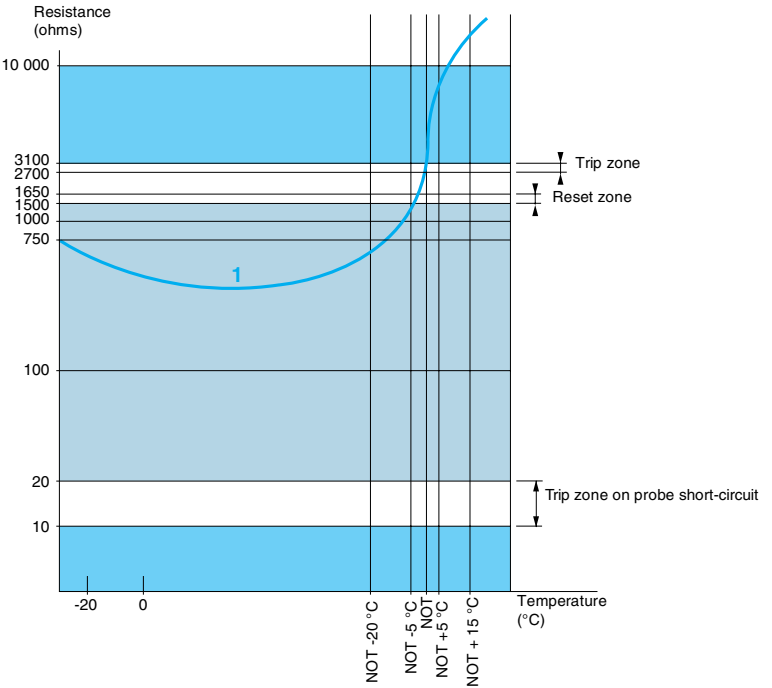
Protection components

Thermistor protection units
for use with PTC thermistor probes ⁽¹⁾

LT3 S protection unit/thermistor probe combination

Guaranteed operating zones: examples with 3 probes type DA1 TT●●● (250 Ω at 25 °C) in series, conforming to standard IEC 60034-11, Mark A.

LT3 SE, LT3 SA, LT3 SM protection units



1 3 probes type DA1 TT●●● (250 Ω at 25 °C) in series.

NOT: Nominal Operating Temperature

- Protection unit tripped.
- Protection unit reset.

(1) PTC: Positive Temperature Coefficient

Protection components

Thermistor protection units for use with PTC thermistor probes ⁽¹⁾



LT3 SE00M



LT3 SA00M



LT3 SM00M

Protection units (without fault memory)

Units with automatic reset with thermistor short-circuit detection

Connection	Voltage	Output contact	Reference	Weight kg
Cage connectors	~ 50/60 Hz 115 V	N/C	LT3 SE00F	0.220
	230 V	N/C	LT3 SE00M	0.220
	24 V	N/C	LT3 SE00BD	0.220

Units with automatic reset with thermistor short-circuit detection

On front panel: fault and voltage signalling indicator.

Connection	Voltage	Output contact	Reference	Weight kg
Cage connectors	~ 50/60 Hz 115/230 V	N/C + N/O	LT3 SA00M	0.220
	24/48 V	N/C + N/O	LT3 SA00ED	0.220
	~ 50/60 Hz 24...230 V or ---	2 C/O	LT3 SA00MW	0.220

Protection units (with fault memory)

Units with manual reset with thermistor short-circuit detection

On front panel:

- fault and voltage signalling indicator,
- Test and Reset button.

Connection	Voltage	Output contact	Reference	Weight kg
Cage connectors	~ 50/60 Hz 400 V	N/C + N/O	LT3 SM00V	0.220
	24/48 V	N/C + N/O	LT3 SM00E	0.220
	115/230 V	N/C + N/O	LT3 SM00M	0.220
	24/48 V	N/C + N/O	LT3 SM00ED	0.220
	~ 50/60 Hz 24...230 V or ---	2 C/O	LT3 SM00MW	0.220

(1) PTC: Positive Temperature Coefficient

Protection components

Thermistor protection units
for use with PTC thermistor probes ⁽¹⁾



DA1 TT●●●



DA1 TS●●●

PTC thermistor probes ⁽¹⁾

Description	Nominal Operating Temperature (NOT) ° C	Sold in lots of	Unit reference	Weight kg
Integrated triple probes	90	10	DA1 TT090	0.010
	110	10	DA1 TT110	0.010
	120	10	DA1 TT120	0.010
	130	10	DA1 TT130	0.010
	140	10	DA1 TT140	0.010
	150	10	DA1 TT150	0.010
	160	10	DA1 TT160	0.010
	170	10	DA1 TT170	0.010
Surface probes	60	10	DA1 TS060	0.005
	70	10	DA1 TS070	0.005
	80	10	DA1 TS080	0.005
	90	10	DA1 TS090	0.005
	100	10	DA1 TS100	0.005

Accessories (to be ordered separately)

Mounting accessories

Description	Application	Sold in lots of	Unit reference	Weight kg
Adapter	For fixing on C rail DZ5 MB	10	RHZ 66	0.005

Marking accessories

Clip-in markers (maximum of 5 per unit)	Strips of 10 identical numbers (0 to 9)	25	AB1 R● (2)	0.002
	Strips of 10 identical capital letters (A to Z)	25	AB1 G● (2)	0.002

(1) PTC: Positive Temperature Coefficient

(2) When ordering, replace the ● in the reference with the number or letter required.

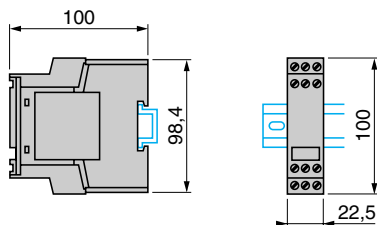
Protection components


Thermistor protection units
for use with PTC thermistor probes ⁽¹⁾

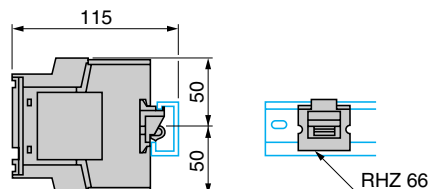
Dimensions

LT3 SE, SA, SM

Mounting on  rail AM1 DP200



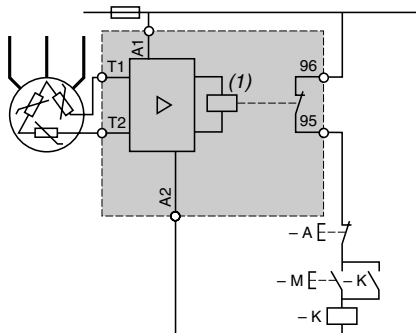
Mounting on 1  rail
(with adapter RHZ 66)



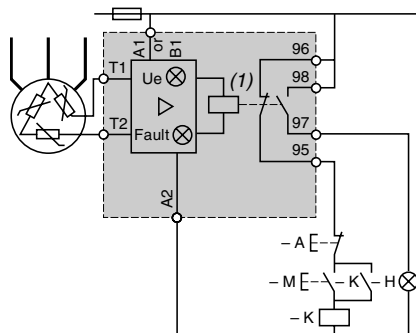
Schemes for "no fault" operation

LT3 SE

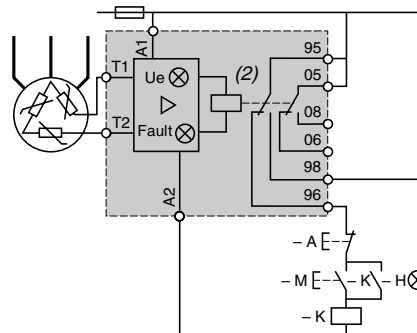
Without fault memory



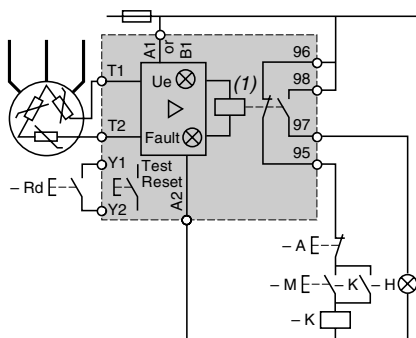
LT3 SA dual voltage



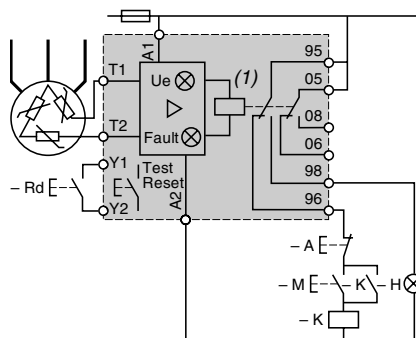
LT3 SA multivoltage



LT3 SM dual voltage and 400 V (without B1)



LT3 SM multivoltage



LT3 S dual voltage

Terminal	A1	B1
Voltage	48 V	24 V
	230 V	115 V

Setting-up

Cabling

It is inadvisable to use the same multi-core cable for the thermistor probe circuit and the power circuit. This is especially important for long cable runs. If it is impossible to comply with the above recommendation, a pair of twisted conductors must be used for the thermistor probe circuit.

Testing the insulation of the line connecting the thermistors to the LT3 S unit

Before carrying out this test, short-circuit all the terminals of the LT3 S protection unit.

Measure the insulation value between these terminals and earth using a megger or a flash tester, progressively increasing the voltage to the value defined by the standards.

Checking the PTC thermistor probes for correct operation

With the machine stopped, in the cold state and after having taken all the necessary safety precautions:

- disconnect the line linking the thermistors to the LT3 S protection unit, at the terminals of the machine being protected: motor, etc.,
- using an ohmmeter with a voltage rating less than or equal to 2.5 V, measure the resistance of the probe circuit at the machine terminals,
- depending on the number and type of thermistors connected in series, check that their resistance value at 25 °C is correct.

Example: motor fitted with 3 PTC thermistor probes with a resistance $\leq 250 \Omega$ at 25 °C.

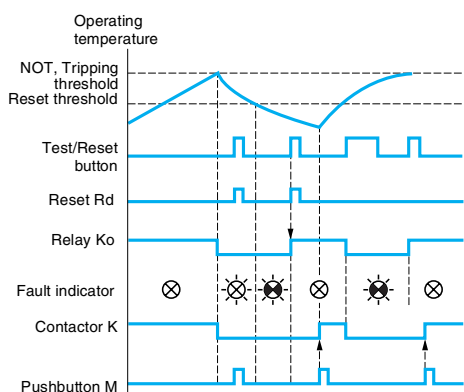
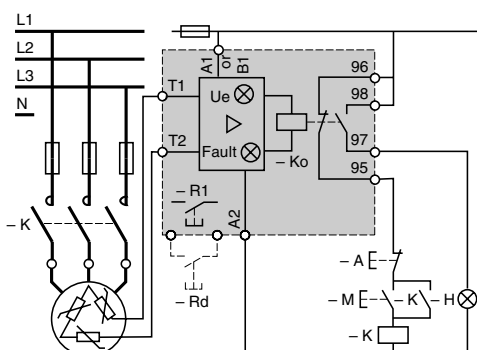
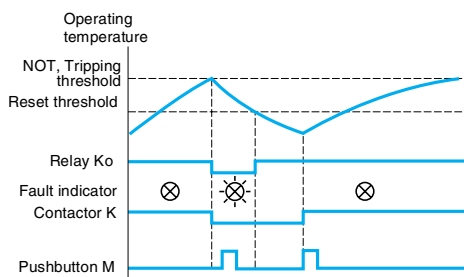
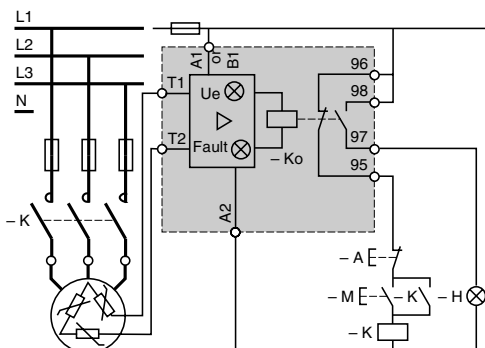
Any value higher than $250 \times 3 = 750 \Omega$ indicates a problem.

(1) PTC: Positive Temperature Coefficient

(2) Relay energised: the contacts are shown in the "operating" position.

Protection components

Thermistor protection units
for use with PTC thermistor probes ⁽¹⁾



LT3 SA protection units

Starting

The LT3 SA is normally energised and its internal relay is in the pre-energised position.
The motor is started by operating pushbutton M automatically held in by K (3-wire control circuit).

Thermal fault

The strong increase in resistance of the PTC probes at the moment their temperature reaches the nominal operating temperature (NOT) is detected by the LT3 SA unit and causes the relay to drop out; indicator H comes on, as does the built-in indicator on unit LT3 SA.
Contactor K drops out and pressing button M has no effect.

Reset

As the motor cools, it reaches the reset threshold, 2 to 3°C below the nominal operating temperature.
The relay resets and the motor can be started by pressing button M.

LT3 SM protection units

Operation is very similar to that described above, except for the following:

Reset

After tripping on thermal fault and cooling to the reset threshold, the Test/RESET button on the unit (R1) or a remote reset button (Rd) must be pressed to energise the relay.

The fault is therefore memorised, even though the temperature of the probes has dropped to well below the reset threshold.

Signalling circuit

As the relay is fitted with 2 separate contacts, the signalling voltage may be different from the contactor control voltage.

Test

Pressing the Test/RESET button simulates a fault and causes the relay to drop out: the FAULT indicator comes on, as does the remote signalling indicator. The unit is reset by pressing the Test/RESET button again.

(1) PTC: Positive Temperature Coefficient

Presentation

The RM1 XA electromagnetic relay detects over current peaks in excess of the maximum permissible current value. It is designed for the protection of circuits which are not subject to current peaks (starters, resistors) or for controlling starting peaks on slip ring motors.

It trips instantaneously and is not suitable for frequent operation (12 operating cycles per hour). It can withstand a continuous current equivalent to 1.25 times the minimum setting current.

Environment characteristics

Conforming to standards		Standard version NF C 63-650, VDE 0660
Approvals		CSA
Protective treatment		Standard version "TC", special version "TH"
Ambient air temperature around the device	°C	Storage: - 60...+ 70 Operation: - 40...+ 60
Maximum operating altitude	m	3000
Operating position		± 15° in relation to normal vertical mounting position

Electrical characteristics of power circuit

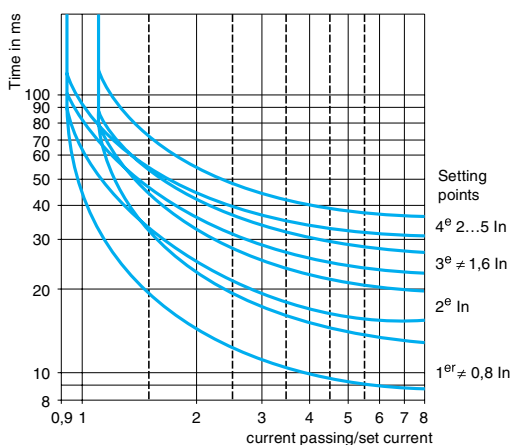
Maximum rated operational voltage	V	~ or --- 600
Frequency limits of the rated operational current	Hz	0...60

Electrical characteristics of auxiliary contacts

Conventional thermal current			A	10				
Occasional making and breaking capacities	a.c. supply	Voltage	V	48	110	220	380	600
		Power (1)	VA	4000	12 000	17 000	22 000	—
	d.c. supply	Voltage	V	48	110	220	440	600
		Power (2)	W	240	200	190	180	180

(1) Circuit such as the electromagnet of a contactor - $\cos \varphi$ inrush: 0.7 and $\cos \varphi$ sealed: 0.4.
(2) Circuit such as an electromagnet without economy resistor ; time constant varying from 20 ms for 5 W to 200 ms for 100 W or more.

Operating times



Operating times: because of the numerous applications for RM1 XA over current relays, it is not possible to give precise operating times. The curves shown are therefore purely indicative.

Protection components

Single-pole magnetic over current relays



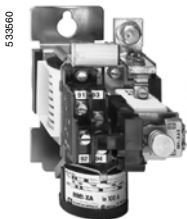
RM1 XA001

Non-latching					
With 1 C/O contact block, non-latching					
Recommended operating range (motor In)		Setting range (trip current)	Maximum continuous current ~ or ==	Reference	Weight
A		A	A		kg
~ or ==	0.7...1.15	1.25...4	1.6	RM1 XA001	0.990
	1.16...1.8	2...6.3	2.5	RM1 XA002	0.990
	1.9...2.9	3.2...10	4	RM1 XA004	0.990
	3...4.6	5...16	6.3	RM1 XA006	0.990
	4.7...7.2	8...25	10	RM1 XA010	0.990
	7.3...11.5	12.5...40	16	RM1 XA016	0.990
	11.6...18	20...63	25	RM1 XA025	0.990
	18.1...29	32...100	40	RM1 XA040	0.990
	29.1...46	50...160	63	RM1 XA063	0.990
	46.1...72	80...250	100	RM1 XA100	0.990
	73...115	125...400	160	RM1 XA160	0.990
	116...145	160...500	200	RM1 XA200	0.990
	146...230	250...800	315	RM1 XA315	0.990
	231...360	400 ...1250	500	RM1 XA500	0.990
	~	361...630	630...2200	1000	RM1 XA101
==	361...570	630...2000	1000	RM1 XA101	0.990
Accessory (to be ordered separately)					
Description				Reference	Weight kg
1 C/O contact block, non-latching				RM1 ZG21	0.060

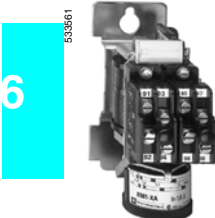
Protection components
Single-pole magnetic over current relays



RM1 XA0011



RM1 XA1001
+
ER1 XA2●



RM1 XA0011
+
RM1 ZH21

Latching with manual reset

With 1 C/O contact block, latching with manual reset

Recommended operating range (motor In)	Setting range (trip current)	Maximum continuous current ~ or ==	Reference	Weight	
A	A	A		kg	
~ or ==	0.7...1.15	1.25...4	1.6	RM1 XA0011	0.990
	1.16...1.8	2...6.3	2.5	RM1 XA0021	0.990
	1.9...2.9	3.2...10	4	RM1 XA0041	0.990
	3...4.6	5...16	6.3	RM1 XA0061	0.990
	4.7...7.2	8...25	10	RM1 XA0101	0.990
	7.3...11.5	12.5...40	16	RM1 XA0161	0.990
	11.6...18	20...63	25	RM1 XA0251	0.990
	18.1...29	32...100	40	RM1 XA0401	0.990
	29.1...46	50...160	63	RM1 XA0631	0.990
	46.1...72	80...250	100	RM1 XA1001	0.990
	73...115	125...400	160	RM1 XA1601	0.990
	116...145	160...500	200	RM1 XA2001	0.990
	146...230	250...800	315	RM1 XA3151	0.990
	231...360	400...1250	500	RM1 XA5001	0.990
~	361...630	630...2200	1000	RM1 XA1011	0.990
==	361...570	630...2000	1000	RM1 XA1011	0.990

Accessories (to be ordered separately)

Description	Reference	Weight kg
1 C/O contact block, latching	RM1 ZH21	0.070
Electrical reset (1) (consumption: inrush, sealed: 500 VA) (fitted to the relay together with a latching contact block) Basic reference. Complete with code indicating control circuit voltage (2)	ER1 XA2●	0.240

(1) The impulse duration must not exceed 2 seconds within 10 minute intervals.

(2) Standard coil voltages for electrical reset:

Volts	24	48	110	220	380
50 Hz	B	E	F	M	Q

Dimensions

RM1 XA●●●,
RM1 XA●●●1

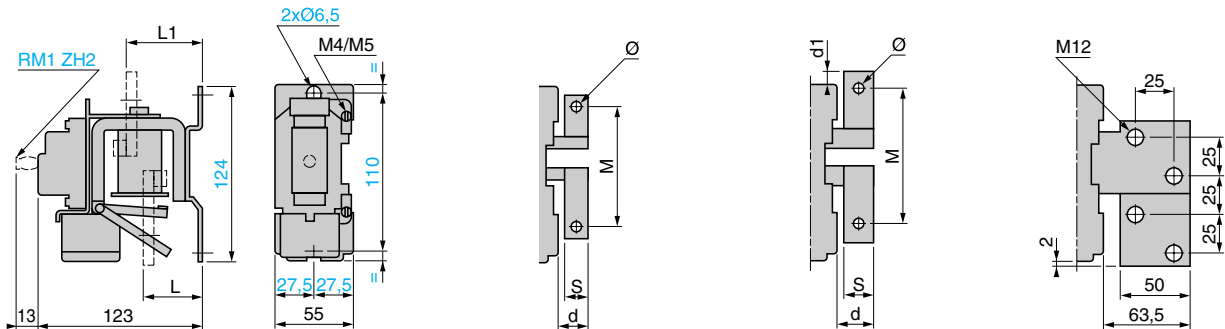
RM1 XA001...XA040
RM1 XA0011...XA0401

RM1 XA063, XA100
and XA315
RM1 XA0631, XA1001
and XA3151

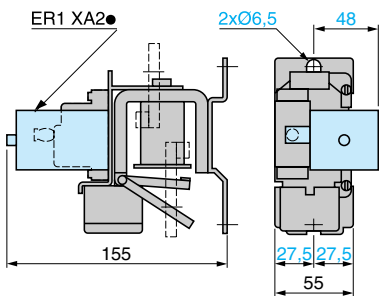
RM1 XA160, XA200,
and XA500
RM1 XA1601, XA2001,
and XA5001

RM1 XA101,
RM1 XA1011

Common side view



RM1 XA●●●1 with electrical reset ER1 XA2●



RM1	d	d1	M	L	L1	S	Ø
XA 063	20.5	—	83	25	40	15	M6
XA 100	20.5	—	87	25	40	20	M8
XA 160	27.5	5.5	94	25	40	25	M8
XA 200	27.5	5.5	94	25	40	25	M8
XA 315	35.5	—	74	44	55	30	M10
XA 500	40.5	7	84	44	55	40	M10
XA 101	—	—	—	37	64	—	—

Schemes

RM1 XA●●●1

Latching

RM1 XA●●●

Non-latching

RM1 XA

3-wire control (without
mechanical latching)

2-wire control (with
mechanical latching)

3-wire control
(with "trip" signal)

