Instrument Transformers, Inc.

a division of GE Multilin

Technical Publication ITILOR95

Multiple-Contact Lock-out Relay for Electrical Industry Applications

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UL File No. E101598

LOCK-OUT RELAY SWITCH

INTRODUCTION

The Lock-Out Relay (LOR) with up to 20 sets of N.O. & 20 set of N.C. contacts is used in the electrical power industry. These control relays are often used in conjunction with differential relays for the protection of transformers, buses, and rotating machinery. During a predetermined condition a LOR that has been RESET is electrically tripped to the TRIP position indefinitely. As a result, the LOR automatically locks out other circuit breakers and devices and must be RESET after the condition is eliminated.

OPERATION

The LOR requires no special circuity expect for a N.O. contact (S1) to trip the relay. The selection of the N.O. contact S1 should take into consideration the burden of trip coil and only external targets, since it will close into this current. Since the LOR is self—interrupting the S1 contact need not be concerned with breaking the TRIP circuit.

MANUAL RESET LOR CIRCUIT

The LOR contacts is shown in Figure 1 are normally closed in the reset position. B and G are the tie points that connect the LOR to the control circuit. C and F ate the connection points for the integral trip coil.

The state of the N.O. contact S1 determines whether the LOR is in the TRIP or RESET position. When the LOR is in the RESET position, the N.O. contact of S1 closes to energize the LOR's trip coil. This causes the LOR to open it's N.C. contacts, lock into the TRIP position, and remove itself from the circuit. An orange or black mechanical flag indicates TRIP position Black indicates RESET position.

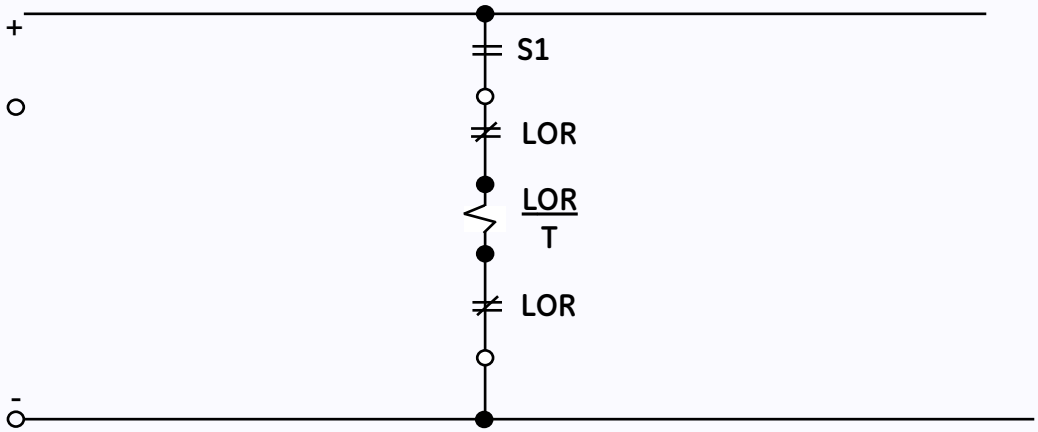


FIGURE 1 MANUAL RESET LOR CONTROL CIRCUIT IN RESET POSITION

OPERATING VOLTAGE & COIL DATA BURDEN

The LOR is self-interrupting auxiliary relay which is energized for short periods of time. Based on 105°C class insulation this relay can be subjected to it's maximum design voltage without exceeding a 50°C rise in a 55°C ambient.

As shown in Fig 2 the LOR operates reliably over a wide range of voltages. Solenoids A, B, C, D, E, and F have overlapping voltages ranges to provide flexibility when selecting an operating speed for a specific burden current G and H coils may be useful where the sum of stray voltages cause nuisance trips. For normal operation the voltage applied at the control bus should be within the operating range outline in Figure 2.

COIL	COIL CKT VOLTAGE	COIL RESISTANCE @ 25°C	OPERATING RANGE	COIL CURRENT @ NORMAL VOLTAGE	COIL CURRENT @ MAXIMUM VOLTAGE VOLTAGE
A	24VDC	3.3	10—40VDC	7.3	12.2 AMPS DC
B	24VDC	7.7	18—50VDC	3.2	6.5 AMPS DC
C	48VDC	1.3	24—70VDC	3.7	5.4 AMPS DC
D	125VDC	27	30—140VDC	4.6	5.2 AMPS DC
E	125VDC	50	45—150VDC	2.5	2.8 AMPS DC
F	250VDC	104	70—280VDC	2.4	2.7 AMPS DC
G	125VDC	27	90—140VDC	2.5	2.8 AMPS DC
H	250VDC	104	180—280VDC	2.4	2.7 AMPS DC

FIGURE 2

The operating range represents the design limits for reliable operation. Safety margins are included so operation may occur well outside this range. There is no implied threshold voltage in the operating range. In fact, actuation may occur at less than half of the lower limit of the operating range - contact factory if threshold voltage levels are required. Recommended control circuitry is shown in Figures 1-8 using a normally open contact to initiate operation. Applying continuous voltages that do not actuate the relay may cause overheating and failure of the coil.

LOR TARGETS

All LOR's have a mechanical target incorporated into nameplate. It's position and color indicate the state of the relay, black for RESET and orange for TRIP. The target resets when the relay resets. Auxiliary targets may be used in combination with LOR to remotely indicate the status of the relay. When wired in series as in Figure 2, the .2A target operates suitably with LOR. However, because of the relay's fast time response the 2A targets need special attention. Refer to figures 4 thru 8 toselect the appropriate coil to target match, and circuit configurations for 2A targets.

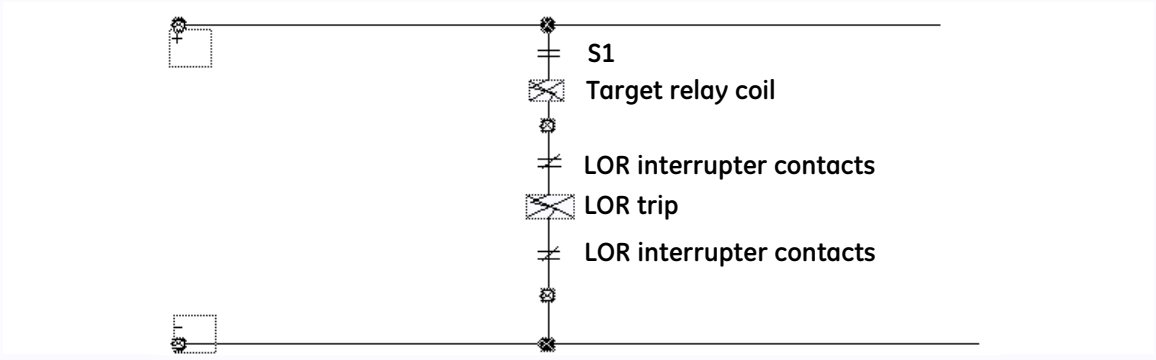


FIGURE 3 SERIES LOR COIL W/TARGET

Tests based on following Target coil Characteristics	TARGET		
	.2A	.6A	2A
Coil resistance (ohms)	8.15	.71	.195
Pull— in current (amps)	.15	.45	1.75

OPERATING DC VOLTS	LOR TRIP COILS TO USE	
	.2 A TARGET	2 A TARGET
150 125	A, B, C B,C,D,E	
150 125 140	D,E,F D,E,F D,E,F	D D
190 250	F F	D D

FIGURE 4 LOR COIL SELECTION

LOR TRIP COIL	NO ADDITIONAL CIRCUITY (TARGET)			2A TARGET RESISTOR (Rp) IN PARALLEL		2A TARGET RC CIRCUIT C1		2A TARGET SERIES RESISTOR (RS)		
	.2A	.6A	2A	25 OHMS	50 OHMS	40 MFD	20 MFD	7 OHMS	12.3 OHMS	16.7 OHMS
A B	12	12	42						90	90
C D	24	40	118		80	95	105	95		
E F	40	150		75 70	150 125					
G	90									
H	180									

FIGURE 5 MINIMUM D.C. VOLTAGE FOR OPERATION OF TARGET

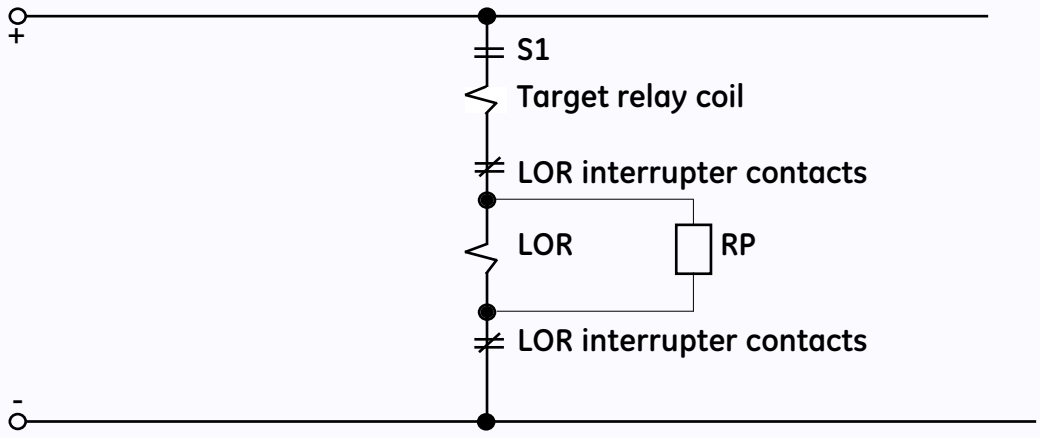


FIGURE 6 LOR TRIP CIRCUIT WITH PARALLEL RESISTER (Rp)
SEE FIG 5 FOR RECOMMENDED VALUES OF Rp.

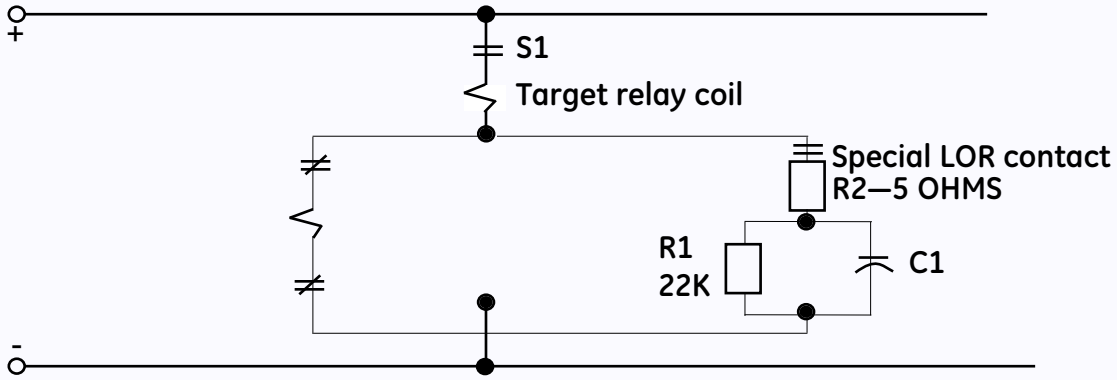


FIGURE 7 LOR TRIP CIRCUIT BRIEFLY CONNECTED WITH RC NETWORK INCREASES CURRENT THROUGH 2A TARGET. SEE FIGURE 5 FOR RECOMMENDED CAPACITOR VALUES.

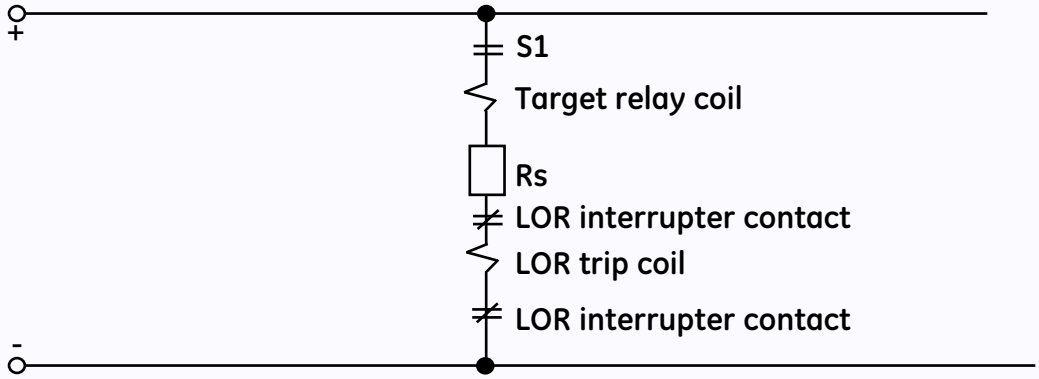


FIGURE 8 SERIES RESISTOR (Rs) IN LOR TRIP CIRCUIT REDUCE COIL WATTAGE. SEE FIGURE 5 FOR CORRECT RESISTOR VALUES.

CONTACT MATERIALS:

The LOR operates to a knife switch with double sided, spring wiper blades that close on a stationary terminal A.N.C. contact is achieved by bridging two stationary terminals. Made of phosphor—bronze, the wiper blades take advantage of the fine electrical conductivity and spring quality it provides. The blades are formed and riveted together to provide uniform pressure betweenthe mating surfaces.

The stationary terminal are made of a copper material.

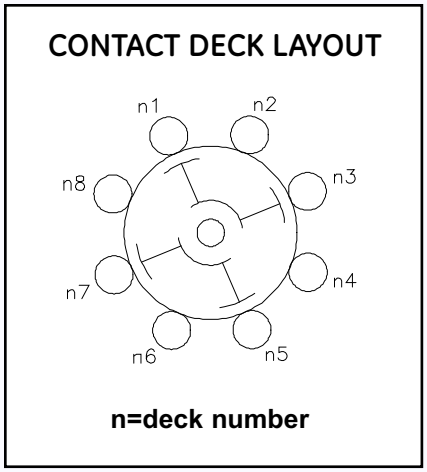
All contact surfaces are overlayed with silver. A final overall silver flashing of the terminals insures good contact for external connections.

DECKS ARRANGEMENT:

A maximum number of 10 decks are available on the LOR for a total of twenty sets of NO and twenty sets of NC contacts. Using a blade and terminal configuration allows each deck to provide two N.O. and two N.C. contacts. Multi—deck LOR's have a two digit number associated with each terminals. The first digit refers to the deck number and the second indicates angular position . Consequently, terminal 68 would be located on the sixth deck in eighth position.

DECK	CONTACTS	POSITION	
		TRIP	RESET
1	11 — 13		X
	12 — 18	X	
	15 — 17		X
	16 — 14	X	
2	21 — 23		X
	22 — 28	X	
	25 — 27		X
	26 — 24	X	
9	92 — 98	X	
	95 — 97		X
	96 — 94	X	
10	101 — 103		X
	102 — 108	X	
	105 — 107		X
	106 — 104	X	

FIGURE 10 CONTACT CHART & DECK LAYOUT



CONTACT RATINGS:

The LOR uses were tested per U.L.Standard 508 and are documented in U.L. File Number E101598. See Figure 11 for actual general purpose U.L. recognized ratings.

U.L RECOGNIZED CONTACT RATING				
120Vac	240Vac	600Vac	125Vac	250Vac
20A	15A	6A	3A	1A

FIGURE 11 CONTACT CHART

TRIP AND REST MECHANISM:

THE LOR uses a small linear solenoid with a mechanical advantage to control the heavy spring action required for tripping. A lever mechanism locks the LOR into the RESET position. Once RESET the full force of the main spring is transmitted perpendicular to a rolling surface. This locks the relay into the RESET position so that neither the lever nor a small roller can move. When energized the solenoid pushes against the lever, the small roller moves, and the LOR trips. Resetting the LOR requires the handle to be rotated clockwise until the roller a lines again with lever.

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