	PROBLEM DESCRIPTION	PROBABLE CAUSE	TECHNICAL NOTES	DELCON'S SOLUTION	
				Relay	Function
AC INPUT	Relay/opto does not release or LED glows by itself or Relay/opto works by itself or irregularly	Capacitive leakage and other disturbances cause incorrect and unexpected functioning	Parallel and/or long cables (>80 m). Load and signal cables nearby. Signal small load	SLI …CR	Normal
	Proximity switch works unreliably	2 wire sensor in use	High leakage on sensor	SLI …CRP	AC-proxy
	Relay works only for a short time	High cycle rate	Contacts work, mechanical life	SLI …CR	Normal
	Optocoupler fails unexpectedly	High transients	Opto damaged by transients	SLI …CH	Transient protected
AC OUTPUT	Relay lasts only a few months	High switching rate	Relay's electric lifetime insufficient	SLO …TR	Normal
	Relay fails immediately	Extremely fast switching	Contact arc does not extinguish	SLO ...IRA	Fast AC
	Opto fails almost immediately	High switching spikes	Poor in overload	SLO …TR	Normal
	Opto works unpredictably	Disturbance or capacitive leakage	Opto has poor switch-on/off hysteresis	SLO …TR	Normal
	Narrow interface relays work unreliably	Disturbance prevents contact release	Large disturbance capacitance relative to coil impedance	SLO …TR	Normal
	Opto switches by itself	Contact spikes	Sensitive triac requires RC snubber	SLO …TR	Normal
	Proximity switch works unreliably	2 wire sensor has leakage current	Property of 2 wire sensors	SLO P…TR	AC-proxy
	Relays do not last	Difficult loads and environment	Repeatedly high surge current	SLO …TR	Normal
	Load comes on "by itself"	Leakage from the opto keeps it on	Feature of RC snubber circuit	SLO …TR	Normal
	Control speed insufficient or incorrect	AC signal requires immediate release	Relay too slow and opto uncertain	SLO …IRA	0,5 ms switching time
DC INPUT	Relay remains on or LED glows by itself or Relay/opto works by itself or Relay/opto works unpredictably	Various disturbances affect the signal and cause incorrect and unexpected actions	Long parallel cables	SLI …CR	Normal
	Pulse counter gives unreliable reading	Electromechanical relays in use	Relay has relatively long release time	SLI …CRF	10 kHz
	Control does not work at the speed of the process	Slow signal response	Relay release time about 15 ms	SLI …CR	0,5 ms switching time
	Relay contacts unreliable	Load too small for relay	Contact corrosion	SLI …CRL	15 mA signal current
DC OUTPUT	Signal needs amplification	Weak signal	Large DC load	SLO …CRX	10 A
	Equipment switches without signal	Leakage from the opto keeps it on	Control current of switching transistor	SLO …CR	Normal
	Relay fails almost immediately	Highly inductive or capacitive loads	Typical with magnetic valves, contactors and lighting	SLO …CRA	1,8A 250VDC, 100 ms
		High DC voltages	110 or 220 VDC used in power stations	SLO …CRA4	4,0A 250VDC, 50 ms

AC INPUT PROBLEMS

INCORRECT STATUS LIGHTS
LED glows even if relay is off; feature of electromechanical relays and opto relays
Delcon relays: the LED is synchronised

RELAY DOES NOT RELEASE
Cable capacitance is large compared to the relays coil inductance.
Even 10 nF may cause errors.
Delcon works with hundreds of nF.

"GHOST" OPERATION
Even 20 nF may cause a relay to come "accidentally" on
Delcon is nearly immune to disturbances
2 wire proxy switch leakage may be 0,5…3,5 mA which causes unexpected operation
Delcon has a special solution for this

CABLE CAPACITANCE
In practice:
4 kW contactor should not be connected with greater than 80 m cable

2 wire signal cable has a capacitance of about 100...300 nF/km.

Even a 100 m cable may cause a relay or opto couple to stay on incorrectly

DELCON'S SOLUTIONS
SLI 230 CR normal
SLI 230 CRP 2-wire sensors
SLI 230CH transient protection

AC OUTPUT PROBLEMS

INCORRECT STATUS LIGHTS
LED on, but relay not on, or LED glowing even though relay has already released.
Feature of relay technology
Delcon relays: the LED is synchronised

INCORRECT OPERATION
Optocoupler may remain on due to capacitive leakage.
Even 10 nF may be enough
Delcon works 100% reliably

UNEXPECTED OPERATION
Unexpected operation may be due to the small impedance of the relay together with unexpected disturbances.
Note: worse with narrow relays
Similar "ghost" operation is also possible with optocouplers
Delcon works 100% reliably

FAST SIGNALING
In fast systems the typical switching time of a mech. relay 15 ms is not enough
Delcon's special relay SLO 24IRA 0,5 ms

CABLE CAPACITANCE
Example:
If contactor's cycle rate exceeds $1x10^6$, cable length should be halved.

DELCON'S SOLUTIONS
SLO 24TR normal
SLO P230TR 2-wire sensors
SLO 24IRA fast release

DC INPUT PROBLEMS

INCORRECT STATUS LIGHTS
LED glows e.g. With low signal voltages when the relay has already opened
Delcon's control circuit ensures switching state is indicated correctly in the LED

RELAY REMAINS ON
Cable capacitance due to long parallel cables is large compared to the relays coil inductance.
Even 10 nF may cause errors.
Delcon works with hundreds of nF.

FAST OPERATION
Pulse sensors in e.g. scales and other demanding applications require fast operation that a mechanical relay can not achieve.
Delcon's special relay has 5 µs switch-on and 20 µs switch off times c. 10x faster than standard DC input

FAST SWITCHING
Applications with a high cycle rate that normal mechanical relays can not achieve reliably.
Delcon relays can switch 10 000 Hz cycle time.

DELCON'S SOLUTIONS
SLI 24CR normal
SLI 24CRF fast switching
SLI 250CH transient protection

DC OUTPUT PROBLEMS

HIGH DC VOLTAGES
Mechanical relay's ability to switch over 30 VDC is weak.

The breaking limit of a typical 24 V 12 A relay with a 250 VDC resistive load is only 0,5 A
Delcon's switching power is unchanged for the whole voltage range.

INDUCTIVE LOADS
The energy created by breaking an inductive load will destroy an electro-mechanical relay very quickly

For example:
An inductive load with L/R = 80 ms at 24 VDC, the maximum breaking capacity of a 12 A electromechanical relay is 0,6 A.

1 A load switching with different loads (L/R) and switching frequency (s)

	L/R	L/R	L/R
s	**20 ms**	**40 ms**	**80 ms**
1/s	30 days	7 days	2 days
1/min	900 days	360 days	90 days

Delcon in all cases > 25 years

If a 24 VDC 2 W valve has current < 100 mA, contact life is less than 360 days.

DELCON'S SOLUTIONS
SLO 24CR normal
SLO 24CRA 250 V or 100 ms
SLO 24CRA4 250 V or 50 ms
SLO 24CRX 10 A