Electronic load relays
Order number 0085-669-04-020000

The electronic load relay is a compact, fully electric, switching element for contactless switching of resistive and inductive DC loads, such as for example electromagnetically actuated clutches, brakes and valves.
It is characterised by a fast, accurately repeatable and wear free switching.
Due to fast demagnetisation of the inductive loads, the negative voltage when switching off is limited to - 30 volts.
The relay has a low voltage fuse and 3 LEDs which indicate the state of the relay. The green LED lights up when the supply voltage is applied and the fuse is in order. The yellow LED lights up when the control voltage is applied and switches the outlet through. When the red LED lights up, the relay is in an unacceptable state.
The control output of the relay recognises an open output in the switched-on state, a short circuit after load voltage and also any unacceptable heating of the relay. In all these cases the control output C switches from high to low and the red LED lights up. If the fuse F fails, output C likewise changes from high to low. In this case the red LED does not light up, and the green LED goes out.
The control and load circuits of the relay are galvanically isolated from each other. The load relay is fitted by simply snapping onto a TS 35 carrier rail.

Technical data

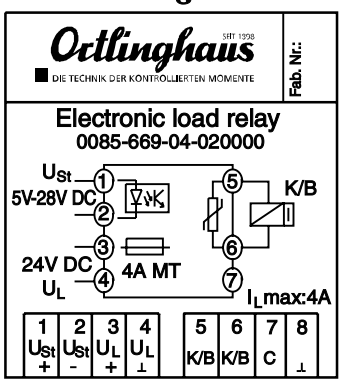
Control voltage	5V - 28V DC (smoothed)
Load voltage	24V DC +/- 10%
Residual ripple (load voltage)	20%
Voltage drop (input/output)	0,5V
Load current	max. 4A
Control out C	24V DC - max. 100 mA
Lead cross-sectional area	max. 2,5mm²
Fuse	4A MT low voltage glass tube fuse
Ambient temperature	0° - 50° C

Connections

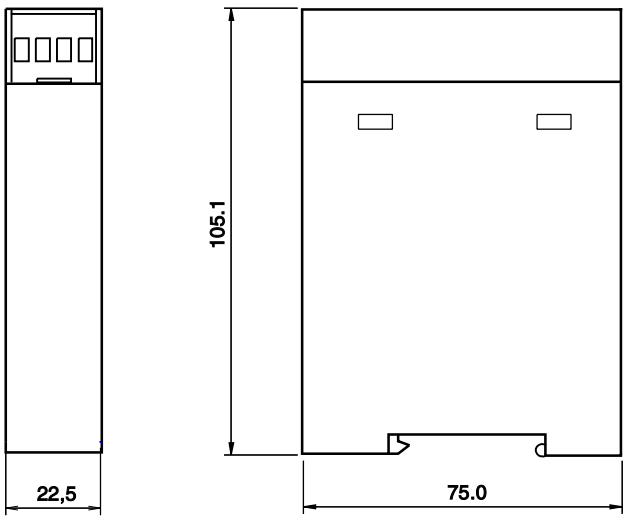
1	U_{ST}	control voltage	5V - 28V DC
2	U_{ST}	control voltage	Ground
3	U_L	load voltage	24V DC
4	U_L	load voltage	Ground
5	K/B	output	
6	K/B	output	Ground
7	C	Control out	
8			Ground

Further relays on request.

Schematic circuit diagram



Dimensions



Coil connections

On clutches and brakes with coil bodies which do not rotate, power is supplied by means of plug connections, connection boxes or by means of a built-in cable on the coil body. Where the coil body rotates, power supply is by means of hardened and ground sliprings. A difference exists between the following versions, namely plugtype brushholders and calipertype brushholders, these being used with coppergraphite brushes for dry-running and woven bronze brushes for wet-running.
One supply line per slipring suffices in the case of dry-running models. With wet-running models, however the sliprings can receive too much oil, the resulting oil film interrupting the power supply. In order to prevent this interruption, it is advisable (and necessary at speeds of 18 m/s and above) to install two power feeds one after the other. Caliper-type brushholders can also be used up to 15 m/s. Power connections must be secured in such a way that they will not be affected by vibration. In order to obtain correct brush pressure, the gap between the brushholder and the slipring must be maintained (approx. 2 mm). Wear should be monitored. Sets of brushes for dry and wet-running models can be supplied separately as spares.

Spark quenching

Due to inductive load, sparks tend to occur between the relay or contacts when the coil is de-energized. In order to prevent erosion, a spark quenching capacitor should be wired parallel to the contacts (circuit in accordance with Fig. 1). Do not use electrolyte capacitors!
More precise switching is obtained when this is carried out on the DC side. The reason for this is that if switching is carried out on the AC side the rectifier must absorb the inductive voltage.
In addition a separate rectifier must then be fitted for each clutch or brake. Spark quenching capacitors are available in two sizes.

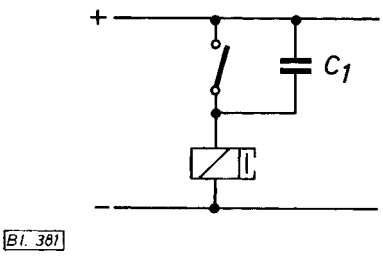


Fig. 1: Connection of the capacitor

Protection against induced current peaks

Induction voltage peaks occurring during disengagement of the clutch/brake can be suppressed by the installation of special varistors, these providing effective protection for insulation and switching elements.

Possible circuits

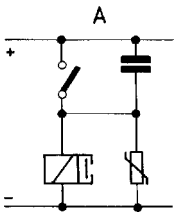


Fig. 2: with varistor

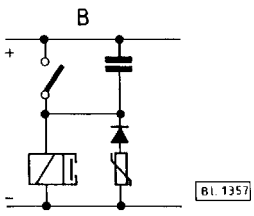


Fig. 3: with varistor and diode in series

The special varistor keeps the peak loading low while ensuring rapid disengagement. There is no heating effect and the rectifier is protected against additional loads. The version illustrated is suitable for all types and sizes of clutches and brakes.
If the operating voltage is to exceed 40 V, the varistor must be wired in series with a diode (1.5 to 2 A - 1000 V).

Effect of the protective elements on the induced current peaks and the disengagement times

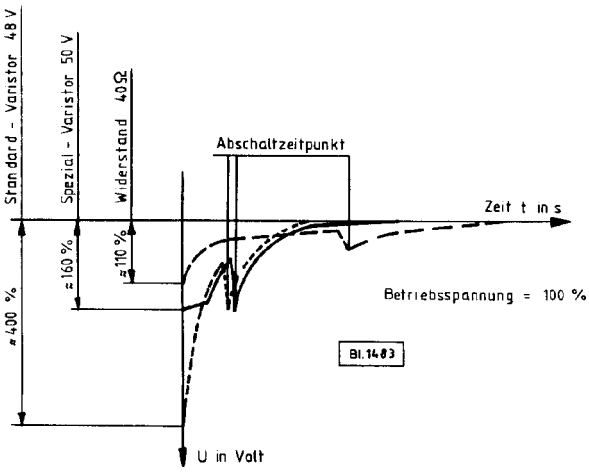


Fig. 4
Abschaltzeit = Disengagement point
Zeit t in s = Time t in s
Betriebsspannung = Circuit voltage
Widerstand = Resistor

Response times

The response times of clutches and brakes can be improved by the use of suitable control circuits and components.

Rapid engagement/application

In order to accelerate torque build-up in electromagnetic clutches and brakes, additional electrical circuits can be installed.
The alternatives are:

Rapid excitation (Fig. 1b)

Excitation of the coil using a series of resistors with an increased voltage. By increasing the circuit resistance, the electromagnetic time constants are reduced.

Over-excitation

Excitation of the coil by increased, time controlled voltage using a bridged series resistor (Fig. 1c), series resistor and capacitor (Fig. 1d) or capacitor with high charging voltage (Fig. 1e).
The coil experiences a momentary high current which gives rise to a steep torque curve.

The comparison shows that the optimum result is obtained with a capacitor with high charging voltage. With the circuits in accordance with Fig. 1b, c and d, the series resistor must be sized in such a way that the voltage drops to the normal operating voltage after engagement.

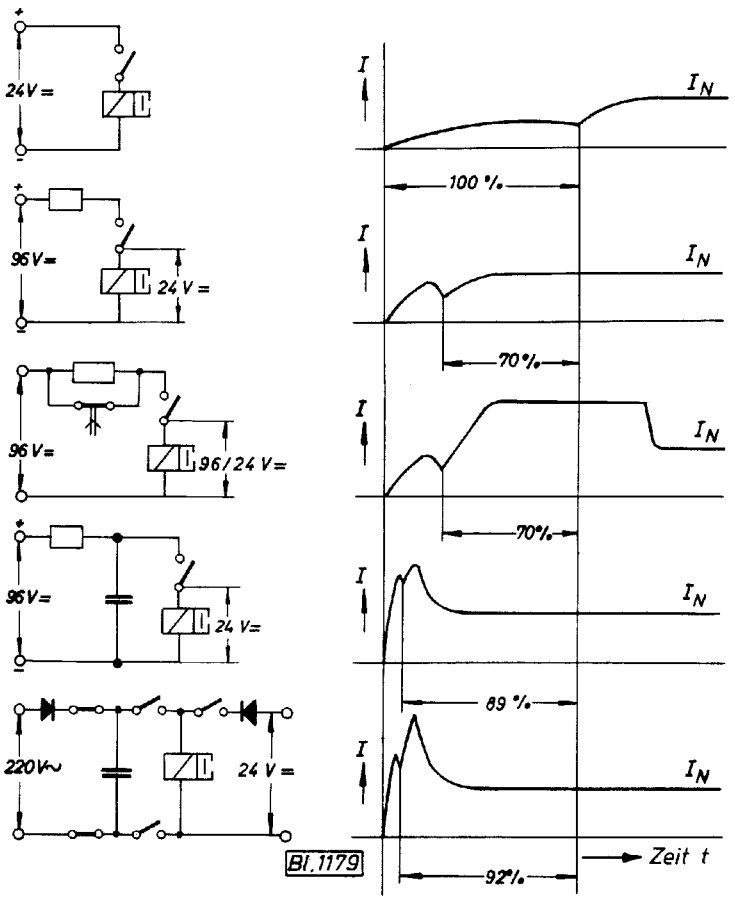


Fig. 1a: Standard excitation

Fig. 1b: Rapid excitation via series resistor

Fig. 1c: Over-excitation via bridged resistor

Fig. 1d: Over-excitation with series resistor and capacitor

Fig. 1e: Over-excitation via capacitor with high charging voltage

Zeit t = Time t

Slow engagement

In some applications smooth acceleration, even of small rotating masses, is required. Controlled torque build-up can be achieved with voltage control, via a variable resistor and single-wave rectification, during the acceleration period. Slow engagement units on request.

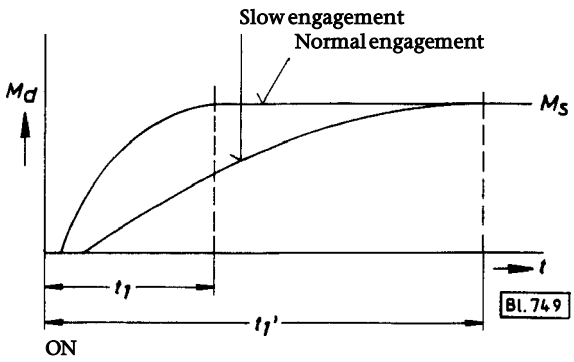


Fig. 1

Rapid disengagement

When the actuating voltage is switched off, a certain amount of residual magnetism will remain. Particularly in the case of clutches and brakes with flux-type plate stacks, this will cause a delay in disengagement.
The residual magnetism can be eliminated very quickly by a short electric impulse with reversed polarity, i.e. counter-excitation.
The effect on the disengagement time of a clutch with flux-type plate stack is shown by way of example in Fig. 2.

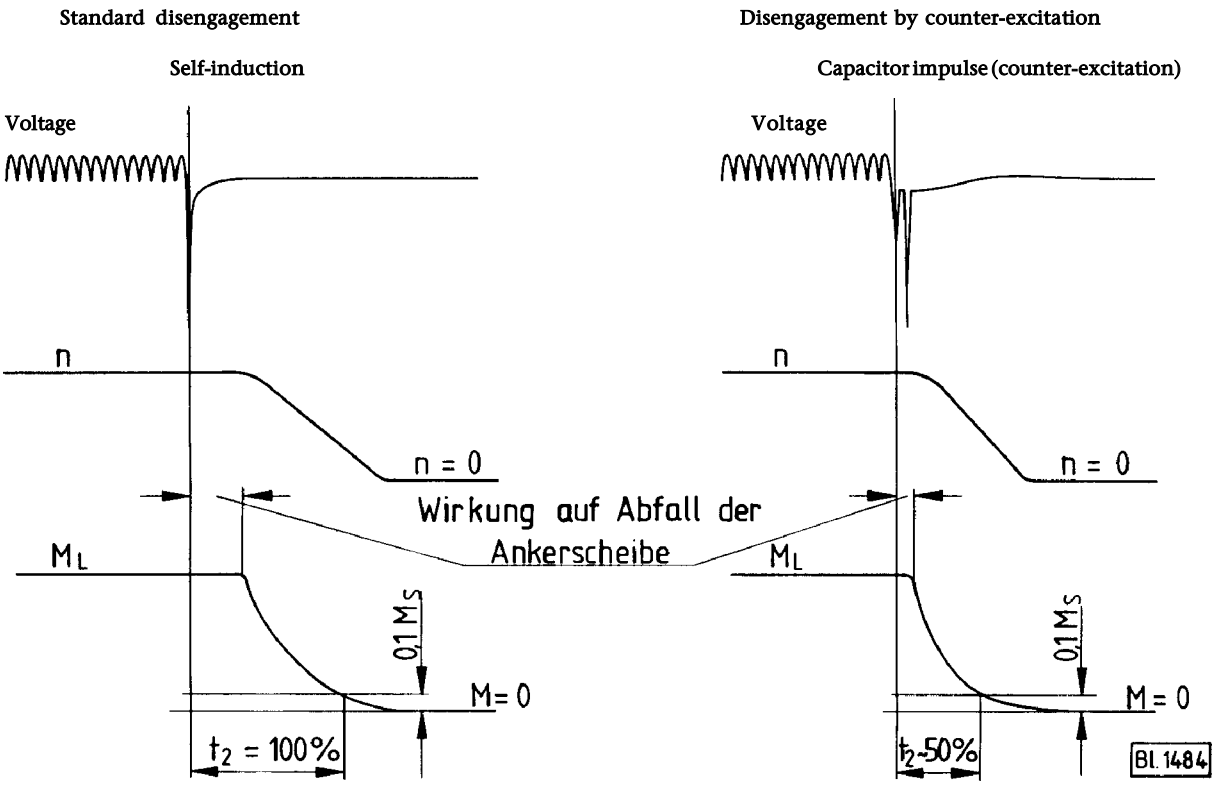


Fig. 2

Wirkung auf Abfall der Ankerscheibe = Effect on armature plate drop-off

Fast starting devices
Order number 0085-609-02-020000

This device serves to shorten the switching time of electromagnetically actuated clutches and brakes.

Operation

Electromagnetically actuated clutches and brakes are designed in the main for operating voltages of 24 V DC. With normal excitation and this voltage, the variation of the current and voltage with time is as shown in Fig. 1. A varistor should be fitted directly to the inductance to be switched in order to limit the negative voltage spikes.
If the inductance is triggered with the rapid starting device, the course of the current and voltage is as shown in Fig. 2. In this case over-excitation of the solenoid coil with approx. 90 V takes place at switching. The increased current resulting from this brings about a shortening of the switching time of up to 75% depending on the particular inductance. The duration of the over-excitation can be set in the range 2 ms to 50 ms with the aid of two trimming resistances on the printed circuit board.
The rapid starting device functions electronically without mechanical relays. The control voltage Uc is separated galvanically from the over-excitation and load voltages with opto-electronic couplers. The state of the device is shown with LEDs:

LED 1 (green) load switched
LED 2 (yellow) load voltage present
LED 3 (red) over-excitation voltage present

Technical data

Control voltage:	6 V–24 V DC (smoothed)
Load voltage:	24 V DC (e.g. rectifier unit 0085-0.0-24-018000)
Over-excitation voltage:	approx. 90 V
Max. load current:	2 A (48 W)
Over-excitation time:	2 ms – 50 ms
Ambient temperature:	0 °C – 40 °C
Max. switching frequency:	200 operations/min.

Terminal loading (on the mounting plate)

Terminal 1:	Terminal 2:
1 + 24 V DC	1 L_1
2 ⊥	2 N
3 + U_C	3 ⏚
4 ⊥ U_C	
5 K/B	
6 K/B	

Schematic diagram for course of voltage and current

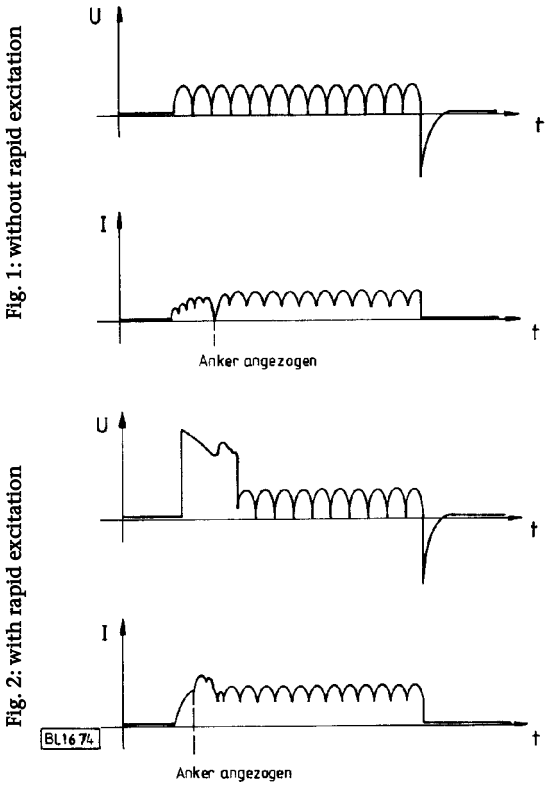
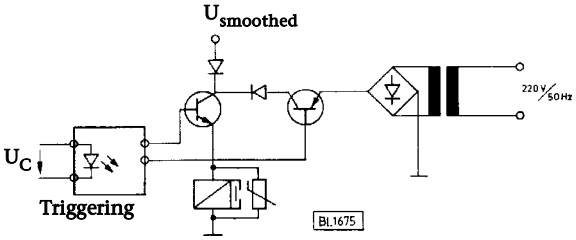


Fig. 1: without rapid excitation

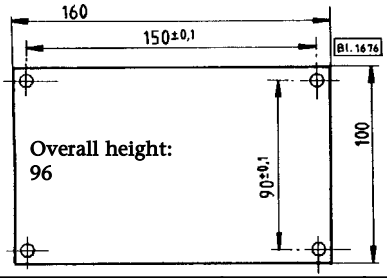
Fig. 2: with rapid excitation

Anker angezogen = armature drawn

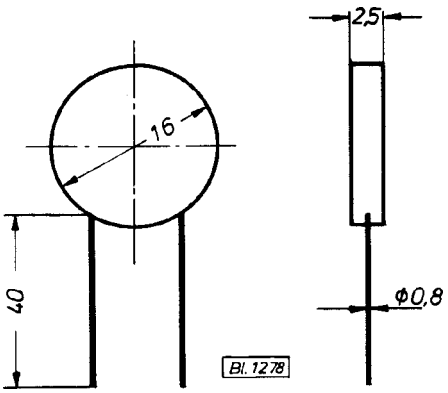
Schematic circuit diagram



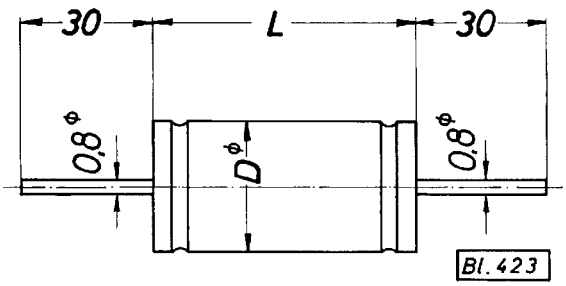
Mounting plate



Special varistors
Order number 0085-800-00-000000
50 V, for all series and sizes



Spark-quenching capacitors



Clutch/brake								Spark-quenching capacitor			
Series	0006 0011	0008 0009 0081	0010	0012	0013	0028 0228	0207	Order number	µF	Dimensions D	 L
Size	07-31	00-33	07-31	03-31	07-31	03-23	02-23	**0085-500-02-000000**	2	20	45
Size	43-59		32-59	43-51	43	31+43	31	**0085-500-04-000000**	4	20	75