Forward-Reverse Motor Control with Limit Switches

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Article address: https://drgmotor.com/en/blog/electric-motors/limit-switch-forward-reverse-motor-control

Technical assumptions

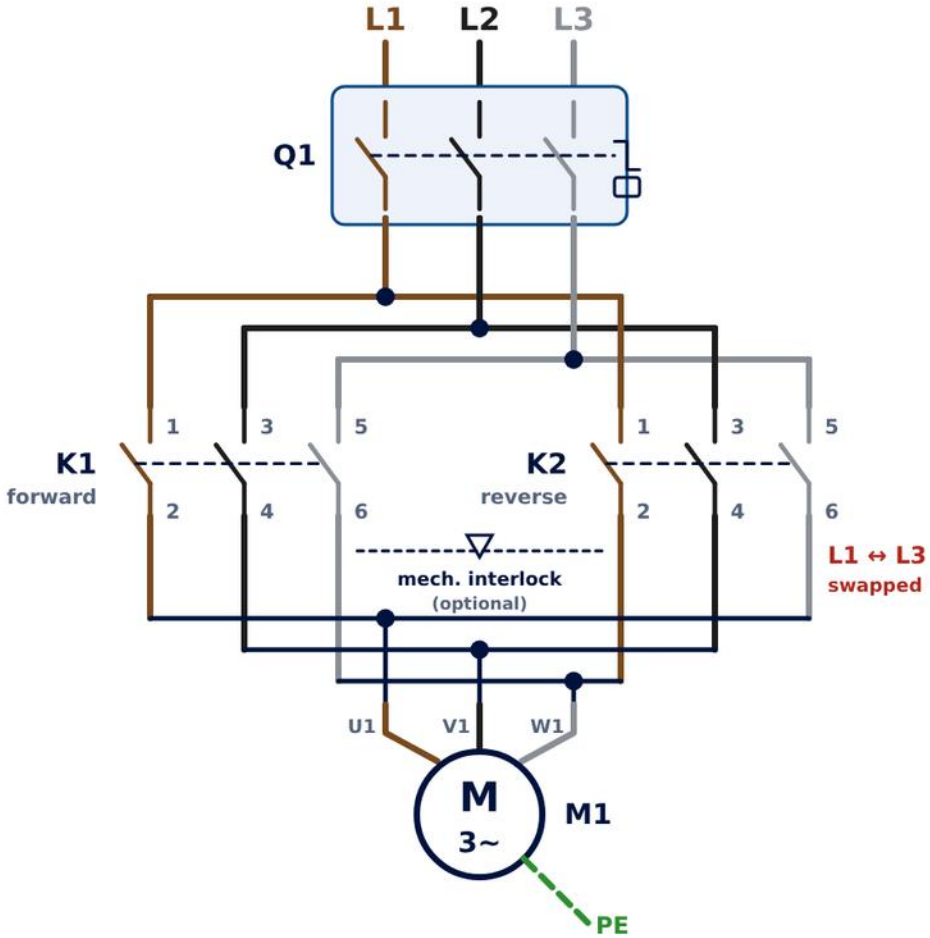
- 400 V 50 Hz three-phase supply; three-phase induction motor rated 230/400 V or 400/690 V.
- Control circuit 230 V AC (example); the same logic applies to a 24 V DC control circuit.
- The NC contact (21-22) of limit switches B1 and B2 is used; terminal names vary by device, the device's own wiring diagram prevails.
- The emergency stop (S9) is not an ordinary stop; the safety function is designed according to the risk assessment.
- Values are examples; protection and contactor selection follow the motor nameplate.

Safety notice

- This content is for technical information only. Wiring, measurement and commissioning must be carried out by qualified electrical personnel, following lock-out and verification of de-energised state, and in line with the motor and device manufacturer's documentation.

Suitable DRG motors and store

- DRG-90S-4 – 1,1 kW: https://drgmotor.com/en/buy-electric-motors-online/1-1-kw-1500-rpm-three-phase-motor-aluminium-drg-90s-4
- DRG-100L1-4 – 2,2 kW: https://drgmotor.com/en/buy-electric-motors-online/2-2-kw-1500-rpm-three-phase-motor-aluminium-drg-100l1-4
- DRG-100L2-4 – 3 kW: https://drgmotor.com/en/buy-electric-motors-online/3-kw-1500-rpm-three-phase-motor-aluminium-drg-100l2-4
- DRG-112M-4 – 4 kW: https://drgmotor.com/en/buy-electric-motors-online/4-kw-1500-rpm-three-phase-motor-aluminium-drg-112m-4
- https://drgmotor.com/en/buy-electric-motors-online



PHASE REVERSAL
K1 on: L1→U1, L2→V1, L3→W1 (forward)
K2 on: L3→U1, L2→V1, L1→W1 (reverse)
Swapping two phases reverses the direction of rotation.

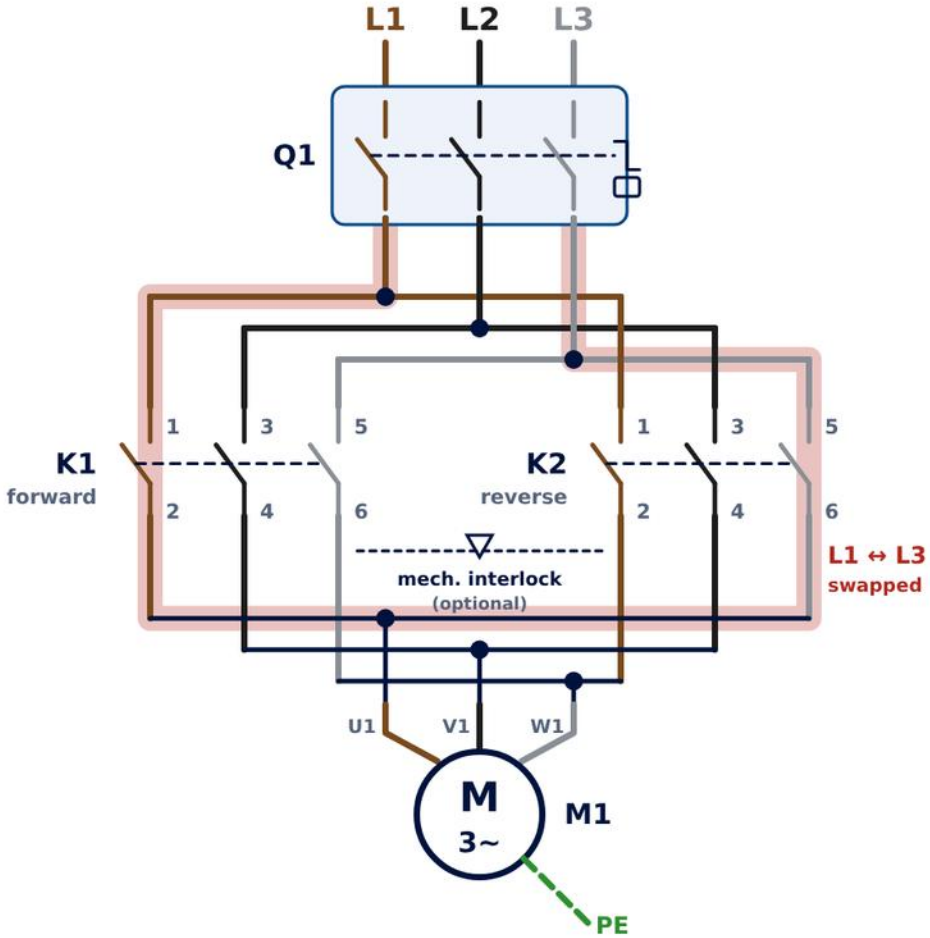
CAUTION
K1 and K2 must never close together:
L1 and L3 would be short-circuited.
Electrical interlock is required.

Q1: motor protection breaker (short circuit + overload)
Set according to the motor nameplate current.

Forward-reverse power circuit: K1 forward, K2 reverse (L1-L3 swap)

Q1 motor protection breaker · K1 forward contactor · K2 reverse contactor · M1 three-phase motor · PE

Figure 1



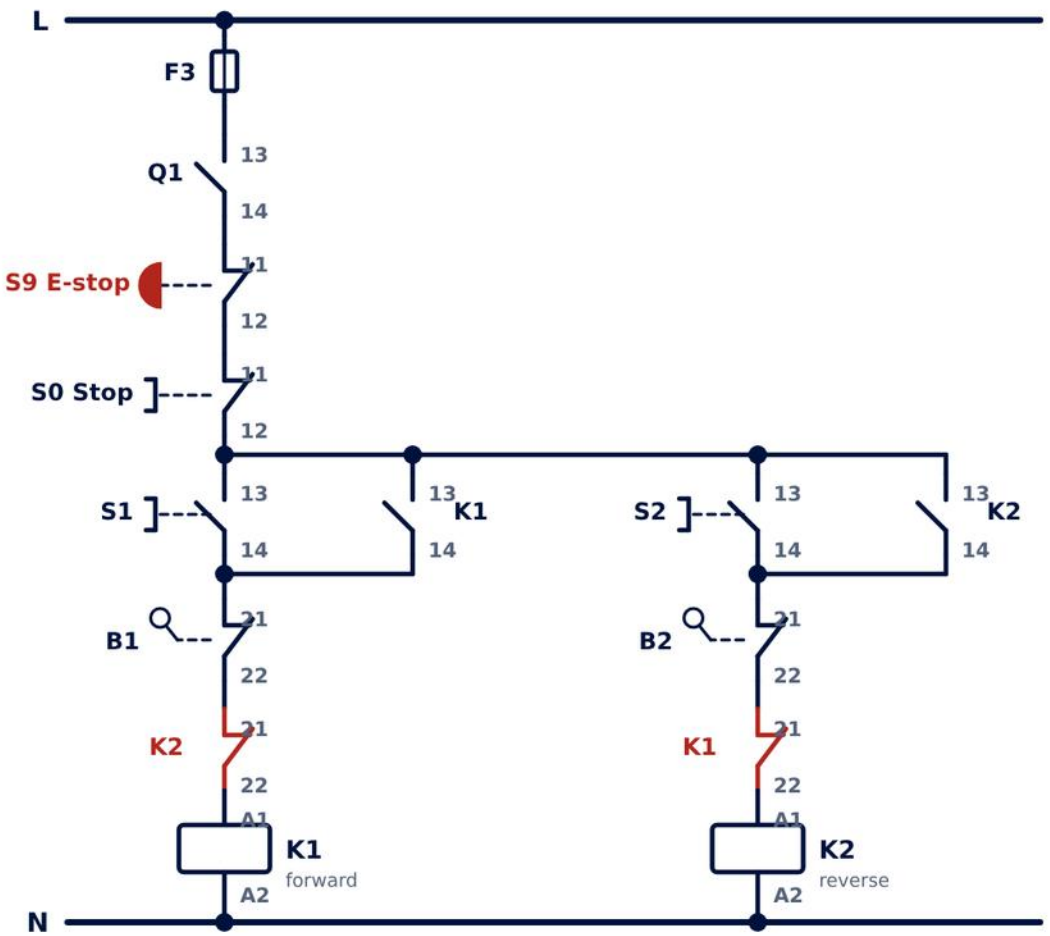
SHORT-CIRCUIT PATH (red)
If K1 and K2 close together:
L1 (via K1) and L3 (via K2) meet
at the same terminal U1.
→ phase-to-phase short circuit,
Q1 trips, contacts may weld.

MEASURES
1. Electrical interlock: K2 21-22 in K1 rung,
K1 21-22 in K2 rung (mandatory)
2. Mechanical interlock (optional, extra)
3. Push-button interlock: crossed NC
contacts (optional, not a substitute)

Short circuit if K1 and K2 close together

Q1 motor protection breaker · K1 forward contactor · K2 reverse contactor · M1 three-phase motor · PE

Figure 2



HOLDING + LIMITS
K1 13-14 → holds S1
K2 13-14 → holds S2
B1 forward end, B2 reverse end (NC), after the holding contact, in series

ELECTRICAL INTERLOCK (red)
K2 21-22 → in K1 rung
K1 21-22 → in K2 rung
One blocks the other.

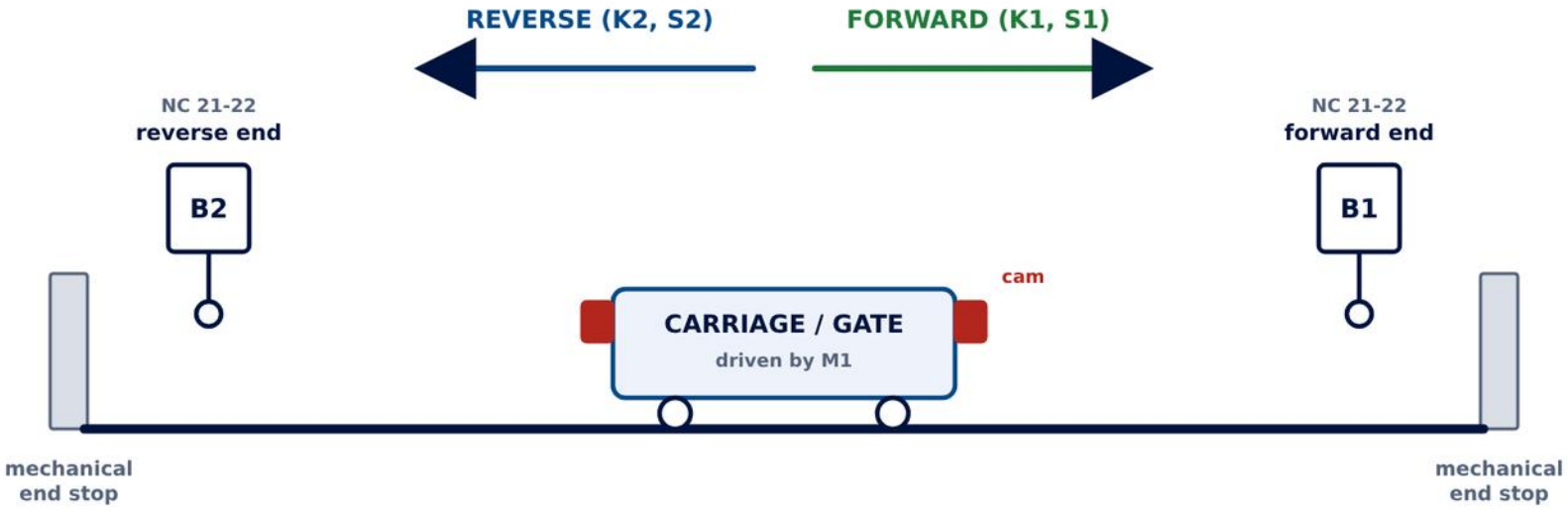
EMERGENCY STOP
S9 is not an ordinary stop.
The safety function is designed according to the risk assessment.

Control 230 V AC (example).
Terminal numbers may vary by device; the device's own diagram prevails.

Forward-reverse control circuit with limit switches

S0 stop · S1 forward · S2 reverse · B1 forward end · B2 reverse end · K1/K2 holding and electrical interlock

Figure 3



When the cam presses B1, B1 21-22 opens → K1 drops out → carriage stops; forward is blocked, only S2 (reverse) works.
B2 does the same for K2. Place each switch so that the coasting distance ends before the mechanical end stop.

Travel path: two limit switches and mechanical end stops

B1 forward end position · B2 reverse end position · cam fixed to carriage · end stops as last resort

Figure 4

DRG MOTOR

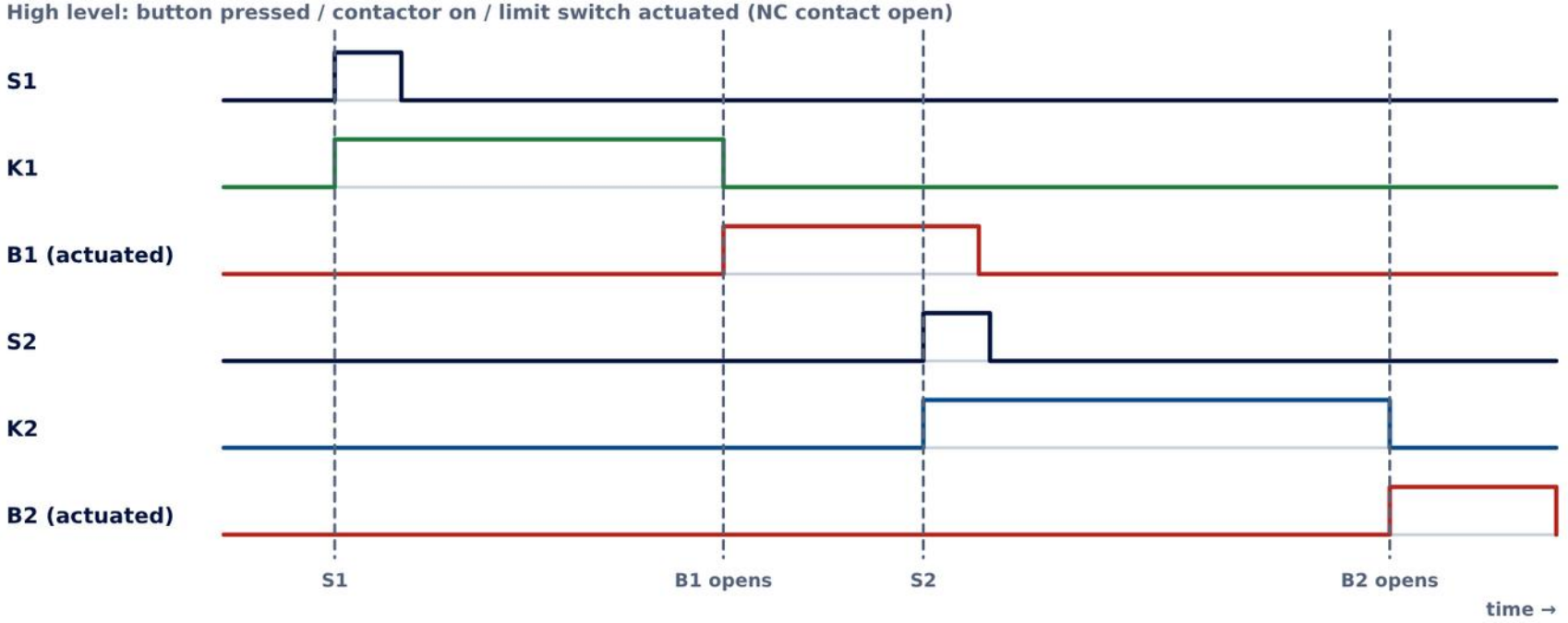
Event	K1	K2	Motor / carriage
Power on, carriage mid-way	0	0	Stopped
S1 pressed	1	0	Moves forward
S1 released	1	0	Keeps moving (holding)
S2 pressed while K1 on	1	0	No change (K1 21-22)
Cam reaches B1	0	0	Stops – forward end
S1 while B1 actuated	0	0	No movement
S2 pressed	0	1	Reverses, B1 released
Cam reaches B2	0	0	Stops – reverse end
S0, S9 or Q1 opens	0	0	Stops, holding released

1 = contactor energised (main contacts closed) · 0 = released. K1 and K2 are never 1 together.

Forward-reverse control with limit switches: state table

State of K1 and K2 and motor behaviour for each event

Figure 5



K1 stays on after S1 is released (holding) and drops when B1 opens. B1 closes again by itself once the carriage moves back off the cam.

Timing diagram: forward – forward end – reverse – reverse end

Sequence of S1/S2 buttons, K1/K2 contactors and B1/B2 limit switches

Figure 6