Dry-Run Protection for Pump Motor Control

Date: 29.10.2026 · Rev. 1

Article address: https://drgmotor.com/en/blog/electric-motors/dry-run-protection-pump-control

Technical assumptions

- 400 V 50 Hz three-phase supply; the 230 V AC control circuit is an example.
- B1 is the dry-run sensor (level electrode, flow switch, pressure switch or current/cos φ monitoring relay); its contact is assumed "water present = closed".
- The K3 bypass time (t_b) and the B1 threshold are set at commissioning according to the pump and installation; no setting values are given here.
- Terminal names (A1-A2, 11-12-14, 13-14, 21-22, 17-18) are generic and vary by device; the device's own wiring diagram prevails.
- Values are examples; equipment is selected from the motor nameplate.

Safety notice

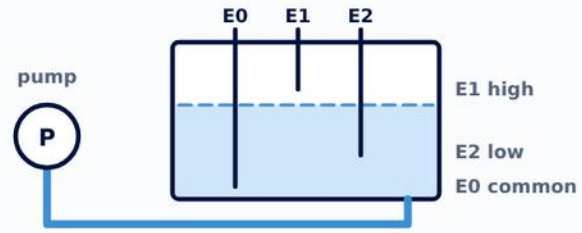
- This content is for technical information only. Wiring, measurement and commissioning must be carried out by qualified electrical personnel, following lock-out and verification of de-energised state, and in line with the motor and device manufacturer's documentation.

Suitable DRG motors and store

- DRG-90L-2: https://drgmotor.com/en/buy-electric-motors-online/2-2-kw-3000-rpm-three-phase-motor-aluminium-drg-90l-2
- DRG-100L-2: https://drgmotor.com/en/buy-electric-motors-online/3-kw-3000-rpm-three-phase-motor-aluminium-drg-100l-2
- DRG-112M-2: https://drgmotor.com/en/buy-electric-motors-online/4-kw-3000-rpm-three-phase-motor-aluminium-drg-112m-2
- DRG-132S2-2: https://drgmotor.com/en/buy-electric-motors-online/7-5-kw-3000-rpm-three-phase-motor-aluminium-drg-132s2-2
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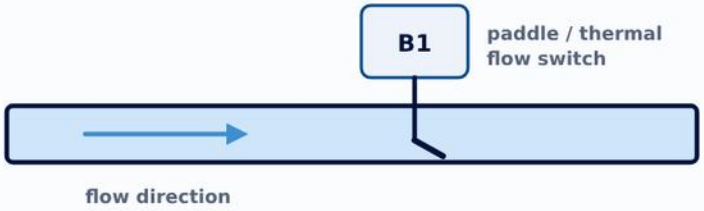
DRG MOTOR

1) Low level in the suction tank



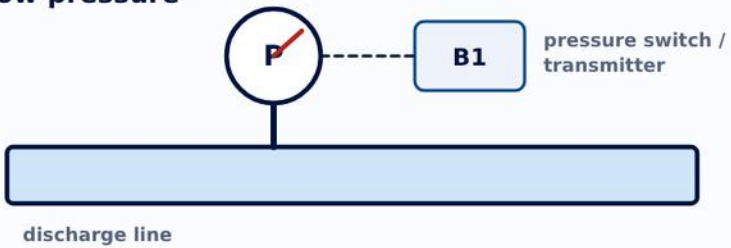
Senses: water level on the suction side
+ Blocks the start before water runs out
− Does not see a closed valve, blocked strainer or air in the suction line

2) Flow switch (no flow)



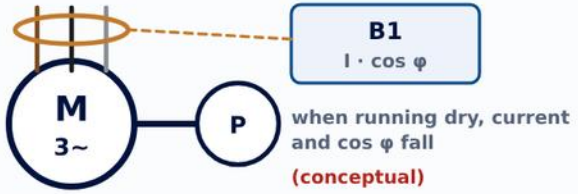
Senses: whether water really flows
+ Also sees a closed valve or air lock
− Flow builds up late at start: a bypass time is needed

3) Low pressure



Senses: discharge (or suction) pressure
+ Often already present in booster sets
− Pressure alone does not prove flow; a bypass time is needed at start

4) Motor current / power factor monitoring

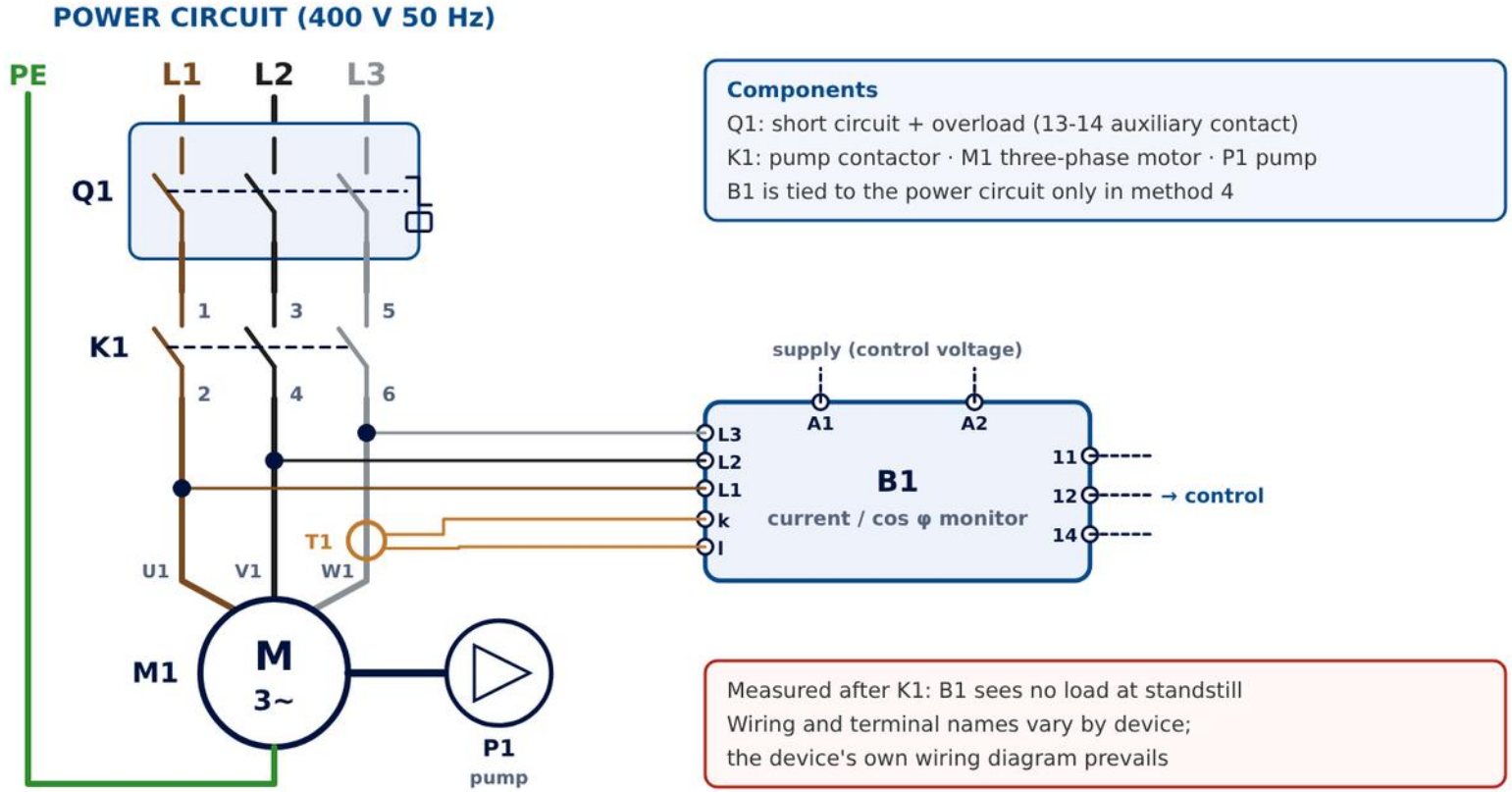


Senses: the drop in pump load
+ No sensor in the pipe, measured in panel
− Measures only while running; the threshold is found at commissioning

Dry-run protection: four detection methods

All do the same job: the B1 contact removes the K1 run permission · terminal names vary by device

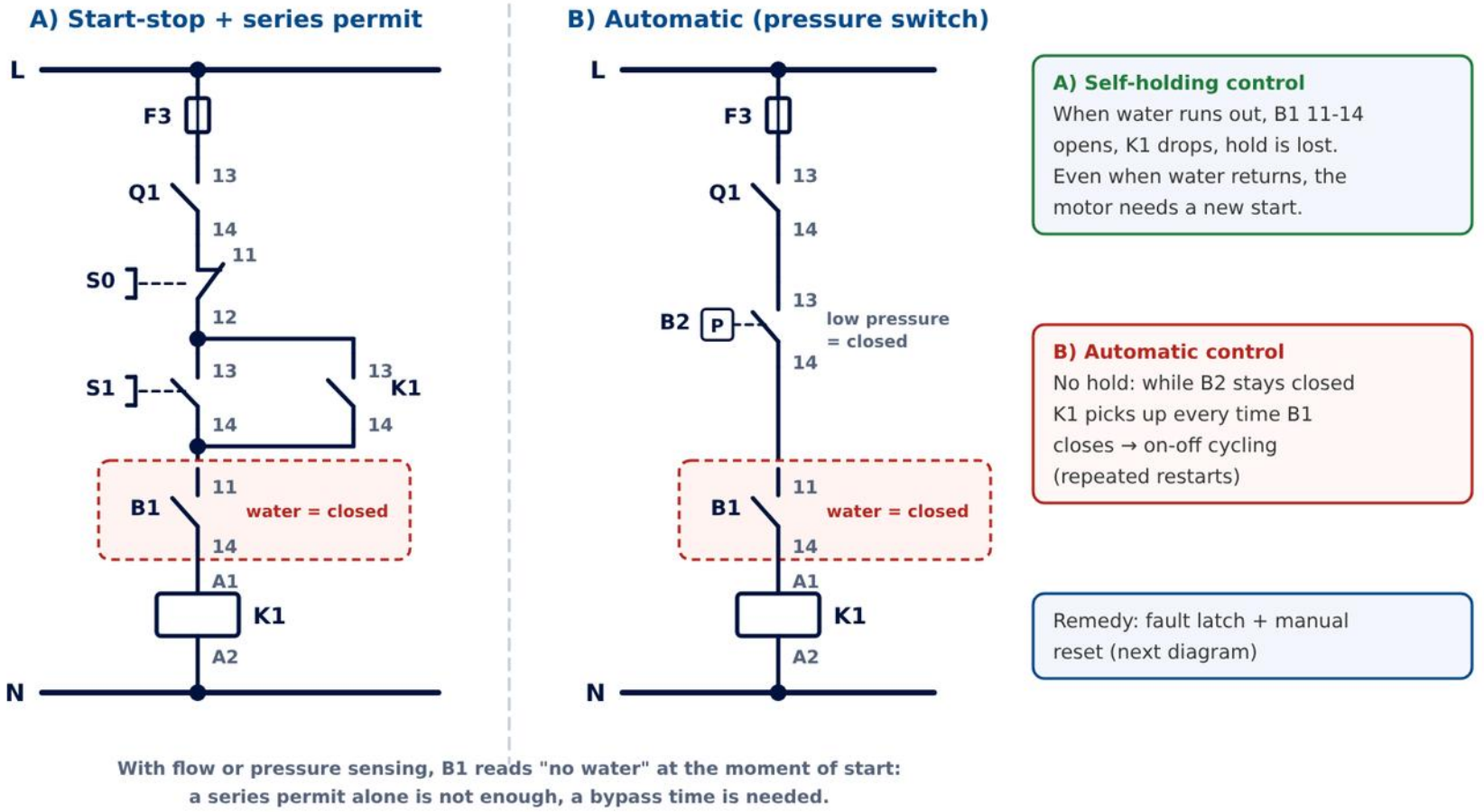
Figure 1



Pump motor power circuit with current monitoring relay

L1-L2-L3 · Q1 · K1 1-2 / 3-4 / 5-6 · M1 3~ + P1 · B1 measuring inputs are conceptual · PE conductor

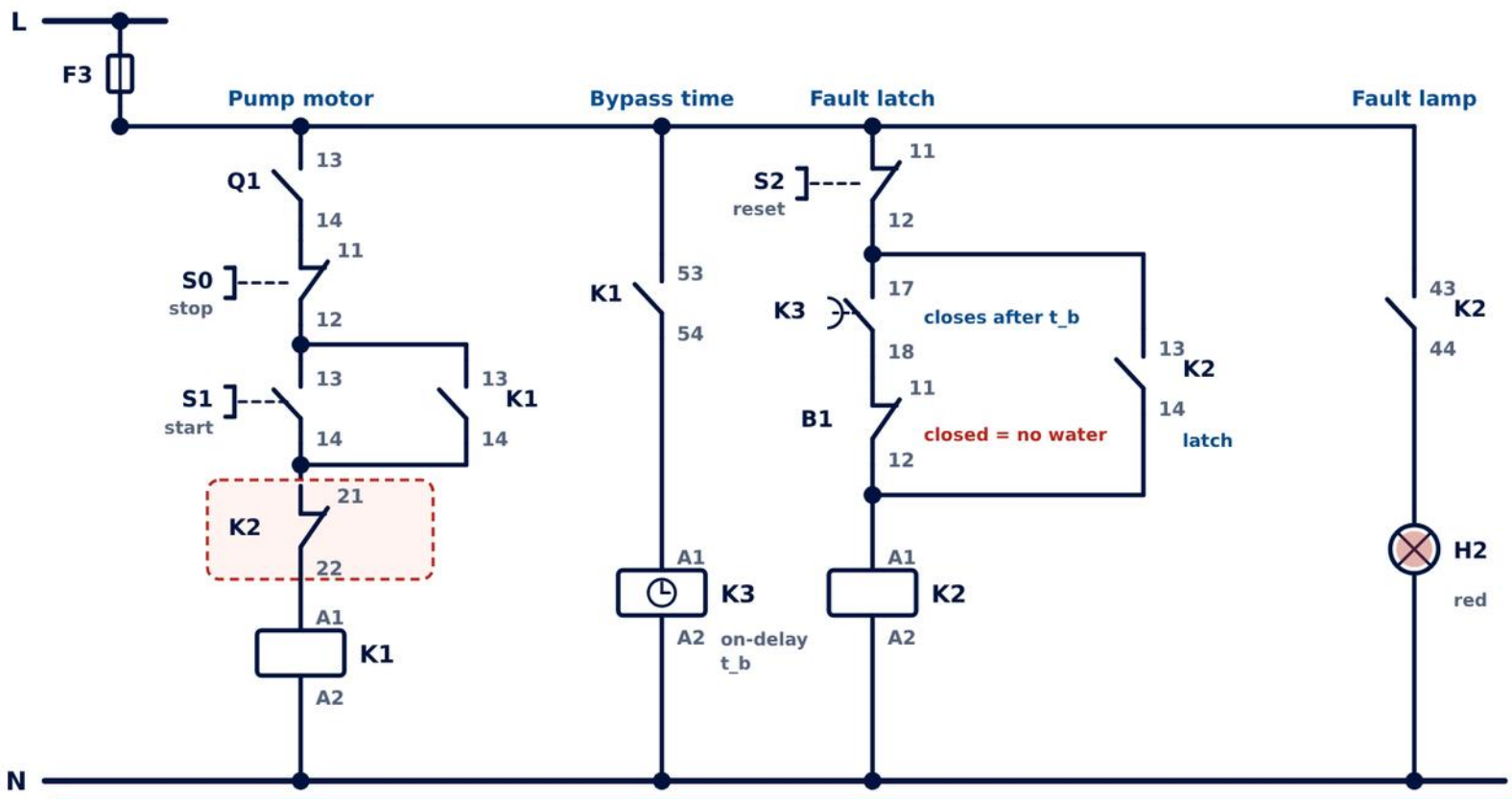
Figure 2



Protection contact in series with the K1 coil: run permission

B1 11-14 (water present = closed) · B2 pressure switch · Q1 13-14 auxiliary · 230 V AC example

Figure 3

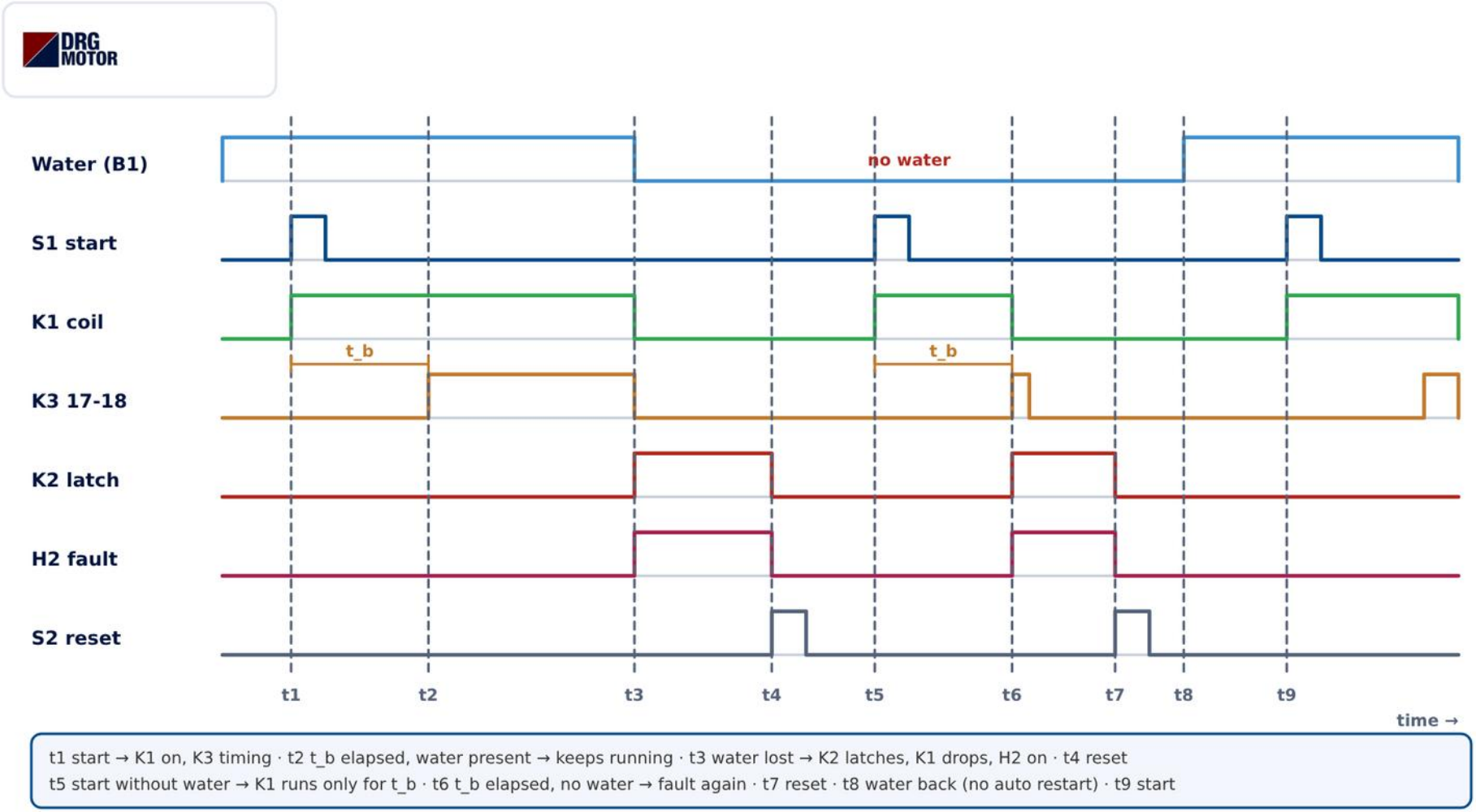


When K1 picks up, K3 times; if there is still no water after t_b (B1 11-12 closed), K2 picks up, holds via 13-14, cuts K1 via 21-22, H2 lights.
K2 stays latched even if water returns: fix the cause, press S2 reset, then start again. t_b is set during commissioning.

Control: bypass time, fault latch and manual reset

L – F3 – Q1 13-14 – S0 – (S1 ‖ K1 13-14) – K2 21-22 – K1 A1-A2 – N · 230 V AC example · terminals vary by device

Figure 4



Dry-run protection: shutdown sequence timing diagram

High level: water present / button pressed / contact closed / coil or lamp energised · t_b = bypass time (set at commissioning)

Figure 5

Step	Water (B1)	K3 17-18	K2 latch	K1 coil	H2	M1
1 Standby	present	open	off	off	off	stopped
2 Start, t_b running	present	timing	off	on	off	runs
3 t_b elapsed, water present	present	closed	off	on	off	runs
4 Water lost while running	none	open	on	off	lit	stopped
5 Water back, no reset	present	open	on	off	lit	stopped
6 S2 reset pressed	present	open	off	off	off	stopped
7 Start without water	none	timing	off	on	off	runs briefly
8 t_b elapsed, still no water	none	open	on	off	lit	stopped

Step 5: K2 stays latched when water returns, so the motor does not restart by itself. Step 8: a dry start runs the pump only for t_b.

Dry-run protection state table

Water, bypass contact, fault latch, K1, fault lamp and motor at each step

Figure 6