

# Test Your Motor Control IQ

Can you ace this duplex pump controller circuit quiz?

By Larry Baran, Motor IQ Columnist

This is a sequence of operation quiz for a duplex pump controller circuit. The system uses two pump motors that alternate every time the water rises, thereby sharing the pump duty. If the water volume is too much for one pump to handle, they both come on simultaneously and stay on until water levels drop. Then both motors shut off.

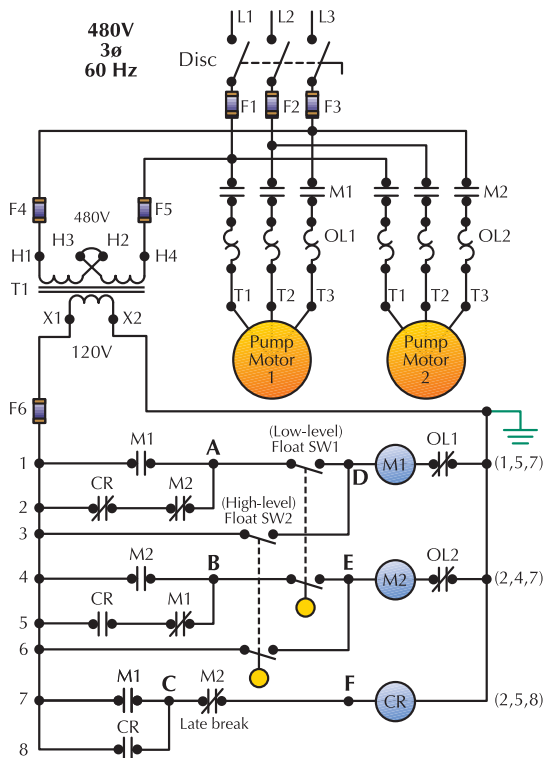
The starting conditions of the duplex pump setup are 480V power on, DISC closed, Transformer T1 powered, control relay CR off. Based on the above, see if you can match the best operating sequence(s) to each condition below. You may have more than one operating sequence for a specific condition.

**Conditions:**

1. Water rises for the first time. Float SW1 closes;
2. Water pumps out normally for the first time. Float SW1 opens;
3. Water rises the for second time. Float SW1 closes;
4. Water pumps out normally for the second time. Float SW1 opens;
5. Water rises for the third time. Float SW1 closes;
6. Too much water is coming in. Two pumps are needed. Float SW2 closes;
7. Water level drops. Float SW2 opens; and
8. Water pumps out for the third time. Float SW1 opens.

**Operating sequences:**

- A. Starter M1 is energized.
- B. Starter M2 is energized.
- C. CR is energized.
- D. M1 contacts change state(NO close/NC open).
- E. M1 contacts change state(NO open/NC close).
- F. M2 contacts change state(NO close/NC open).
- G. M2 contacts change state(NO open/NC close).
- H. CR contacts change state(NO close/NC open).
- I. CR contacts change state(NO open/NC close).
- J. No. 1 pump motor starts running.
- K. No. 2 pump motor starts running.
- L. Both pumps remain running.
- M. CR remains energized.



- N. Both pumps stop running at the same time.
- O. No. 1 pump motor stops running.
- P. No. 2 pump motor stops running.
- Q. M1 and M2 turn off at the same time.
- R. Starter M1 turns off.
- S. Starter M2 turns off.
- T. CR turns off.
- U. "Late break" M2 contact opens.

**Answers: (Parentheses indicate simultaneous action.)**

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|----|------------------|
| 1. | A, D, (I, C), H  |
| 2. | R, E, (O, M)     |
| 3. | B, F, K, U, T, I |
| 4. | S, G, P          |
| 5. | A, D, (I, C), H  |
| 6. | B, F, K, U, T, I |
| 7. | L                |
| 8. | Q, (E, G), N     |

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