Example 7. Maintaining Set Pressure with Transition to Sleep Mode.

Purpose:

Sleep mode is used to provide a software-controlled stop of the variable-frequency drive (RD) in situations where continuous drive operation is not economically justified and the system can remain idle for certain periods of time. Sleep mode reduces energy consumption and prevents the system from exceeding normal operating conditions (excessively high pressure, overcooling of water in cooling towers, or building sealing problems). Sleep mode is also important because some equipment does not allow the RD to reduce motor speed. This can lead to premature wear of pump systems, premature depletion of lubricant in gearboxes, or uneven fan operation.

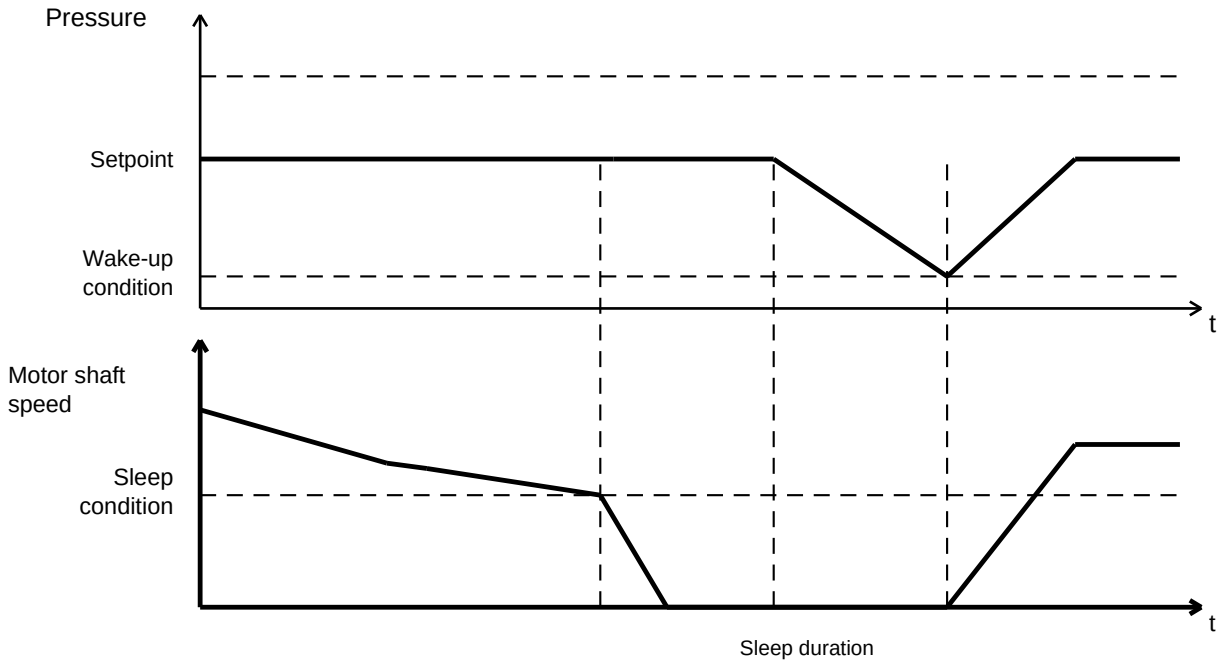


Figure 1. Sleep mode operating diagram

This example shows two wiring configurations:

- Using the internal power supply (Fig. 2).
- Using an external power supply (Fig. 3).

Pressure sensor wiring diagram for RD05
(using the internal power supply)

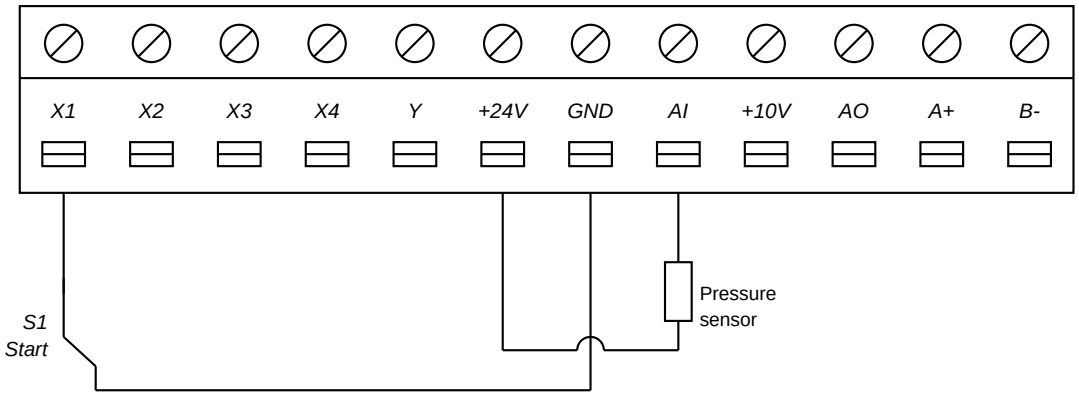


Figure 2. Pressure sensor wiring diagram for the RD (using the internal power supply)

Pressure sensor wiring diagram for RD05
(using an external power supply)

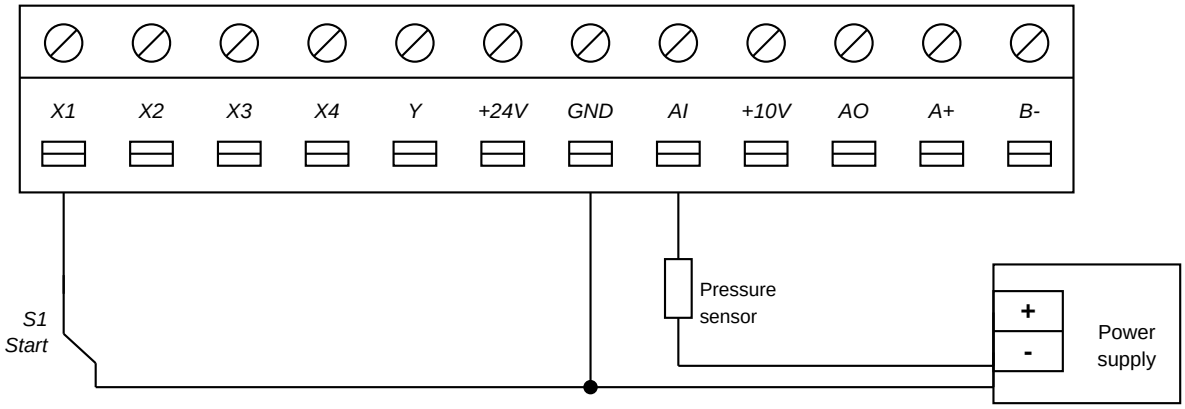


Figure 3. Pressure sensor wiring diagram for the RD (using an external power supply)

Note: When connecting a pressure sensor with a current output signal, the DIP switch (AI in this example) must be set to the **"I"** position.

GND is the common terminal for 0.75-5.5 kW ratings; COM is the common terminal for 7.5-22 kW ratings.

Control Algorithm:

1) The induction motor is started by closing terminals X1 and COM.
2) In automatic mode, the system maintains the set pressure using closed-loop process control.
3) If the motor frequency remains below the value set in parameter F13.30 for the time set in parameter F13.31, the RD enters sleep mode.
4) If the feedback deviates by the value set in parameter F13.32 for the time set in parameter F13.33, the RD returns to motor-speed control according to the PID algorithm.
5) The drive is stopped by opening terminals X1 and COM.

Parameter List.

Table 1. Parameter List.

No.	Code	Parameter	Value	Note
1	F01.01	Run command source	1	Start/stop via digital input
2	F01.02	Frequency reference source	8	Closed-loop process PID control with feedback
3	F01.10	Maximum output frequency	50	Rated nameplate frequency, Hz
4	F01.13	Lower frequency limit setting	0	Minimum motor frequency, Hz
5	F01.22	Acceleration time	5	Water-hammer protection
6	F01.23	Deceleration time	5	Water-hammer protection
7	F02.00	Motor type		According to motor
8	F02.01	Number of poles		According to motor
9	F02.02	Rated motor power		According to motor
10	F02.03	Rated motor frequency		According to motor
11	F02.04	Rated motor speed		According to motor

12	F02.05	Rated motor voltage		According to motor
13	F02.06	Rated motor current		According to motor
14	F05.00	Terminal X1 function selection	1	Forward run
15	F05.20	Control mode selection	0	Two-wire control system 1
16	F05.22	Operating signal selection for terminals X1-X4	0000	Active when contact closes
17	F5.41	AI input signal type	1	Current signal 0...20 mA
18	F5.50	Lower limit of analog input signal	20	Limits the current signal to the 4...20 mA range
19	F7.00	Start mode	2	Flying start (speed search)
20	F13.00	PID setpoint source selection	0	Setpoint is specified in parameter F13.01
21	F13.01	Setpoint or panel feedback value	50	PID setpoint, %
22	F13.03	PID feedback source	2	Pressure sensor feedback
23	F13.07	PID controller setup	0000	PID controller logic configuration
24	F13.11	Proportional component	1	Tuning to reduce overshoot
25	F13.12	Integration time	8	Tuning to reduce overshoot
26	F13.13	Differential component	0.5	Tuning to reduce overshoot
27	F13.29	Sleep mode activation	1	Sleep mode enabled
28	F13.30	Sleep-mode activation frequency	20	Starts the timer when the frequency is reached, Hz
29	F13.31	Delay before entering sleep mode	60	Enters sleep mode after the time elapses, s
30	F13.32	Feedback deviation from setpoint for wake-up activation	20	Starts the timer when feedback deviation is reached, %
31	F13.33	Wake-up activation delay	60	Delay before wake-up, s

At readings below 12 mA, speed is adjusted according to the PID algorithm. When the setpoint is reached, the speed begins to decrease. If the frequency remains at 20 Hz for more than 60 s, the RD goes to sleep and switches to operation at the minimum speed (F01.13). When the AI input receives a signal below 8.8 mA for 60 s (F13.01 [12 mA] minus F13.32 [3.2 mA]), the RD

wakes up and continues control according to the PID algorithm.