Initialization procedure (restoring default settings)

Because of a change in application, or to prevent the operation of the AC Drive with a parameter set to an unexpected value, it is sometimes required to restore the default setting of the parameters.

Perform the following steps to restore the default setting of all parameters:

- Select parameter b084.
- Set the value of parameter b084 to 02(1).
- Press the STOP/RESET key while holding down the Mode and Decrement keys simultaneously. When the display blinks, release the STOP/RESET key first, and then the Mode and Decrement keys.
- When initialization is completed, the data display shows d001.

(1) Setting parameter b084 to 02 clears the trip monitor and initializes data.

Procedure Summary

In the first part of this exercise, you will connect the AC Drive and read the current setting of some parameters. You will compare the current setting to the default setting of the parameters.

In the second part, you will perform the Initialization procedure to restore the default setting of the parameters.

In the third part, you will operate the Brake Motor using the AC Drive. You will also set the AC Drive to display parameters.

EQUIPMENT REQUIRED

Refer to the Equipment Utilization Chart in Appendix A to obtain the list of equipment required for this exercise.

PROCEDURE

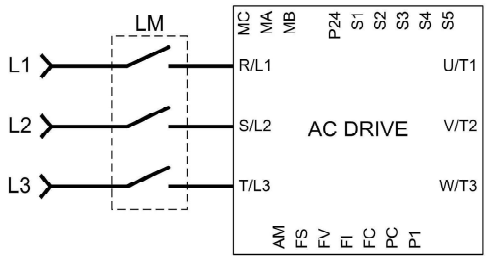
⚠ WARNING

The AC Power Supply provides high voltages. Do not change any AC connection with the power on.

Basic setup

☐ 1. Perform the Basic Setup and Lockout/Tagout procedures described in Appendix C.

☐ 2. Set up the circuit shown in Figure 1-5.



LEGEND

AC DRIVE = THREE-PHASE AC DRIVE
LM = LOCKOUT MODULE

Figure 1-5. AC Drive connected to the Lockout Module.

☐ 3. Perform the Energizing procedure described in Appendix C.

Parameter settings

☐ 4. Read the current values of the following parameters:

A038: _____ A043: _____ b002: _____

b021: _____ C001: _____ C026: _____

☐ 5. Do these values correspond to the default setting of the parameters as indicated in Appendix F? If not, explain why.

_____

_____

Initialization procedure

☐ 6. Perform the Initialization procedure described in the Discussion of this exercise to restore the default setting of the parameters.

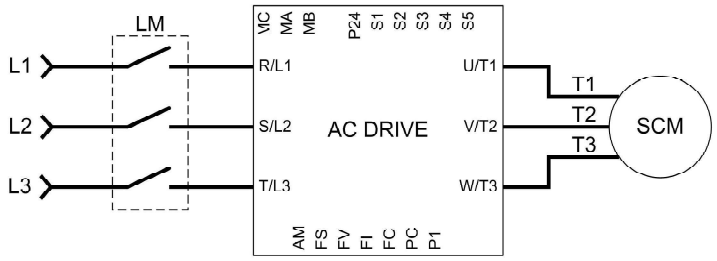
Note: *If the display does not show d001 at the end of the Initialization procedure, repeat the procedure.*

☐ 7. Turn off the Lockout Module.

Basic motor control functions

☐ 8. Install the Brake Motor and Safety Guard.

☐ 9. Set up the circuit shown in Figure 1-6.



LEGEND

AC DRIVE	=	THREE-PHASE AC DRIVE
LM	=	LOCKOUT MODULE
SCM	=	SQUIRREL CAGE MOTOR

Figure 1-6. AC Drive controlling the Brake Motor.

☐ 10. Manually disengage the friction brake.

On the AC drive, turn the FREQ. adjuster fully counterclockwise.

☐ 11. Turn on the Lockout Module.

Set the AC Drive to display the output frequency by selecting parameter d001.

Turn the FREQ. adjuster fully clockwise.

Does the Brake Motor start to rotate?

☐ Yes ☐ No

☐ 12. Press the RUN key to set the AC Drive to the run mode.

Does the Brake Motor start to rotate?

☐ Yes ☐ No

☐ 13. Wait until the motor stabilizes, then enter the output frequency shown on the data display of the AC Drive.

Output frequency: _____

☐ 14. Vary the position of the FREQ. adjuster while observing the frequency shown on the data display of the AC Drive and the speed of the motor.

Does the motor speed slow down as the output frequency is reduced?

☐ Yes ☐ No

☐ 15. Turn the FREQ. adjuster of the AC Drive fully clockwise.

Set the AC Drive to display the output current by selecting parameter d002.

> **Note:** *It is not necessary to stop the AC Drive to modify the display parameters. However, many parameters require the AC Drive to be in the stop mode to be modified.*

Wait until the motor stabilizes, then enter the output current shown on the data display of the AC Drive.

Output current: _____

☐ 16. Which LEDs are lit in this operating mode (run mode)?

_____

_____

_____

☐ 17. Press the STOP/RESET key to set the AC Drive to the stop mode.

Quick parameter selection

☐ 18. Familiarize yourself with the quick parameter selection method by selecting one after the other the following parameters:

A001, b023, C004, and F004

☐ 19. Turn the individual power switch of the AC Power Supply off, disconnect the circuit, and return the equipment to the storage location.

CONCLUSION

In this exercise, you familiarized yourself with the basic operation of the AC Drive. You read the value of some parameters, and performed the Initialization procedure to restore the default setting of the parameters. You operated the Brake Motor, and varied the speed using the FREQ. adjuster. You saw that the quick parameter selection allows you to select the parameters easily and rapidly.

REVIEW QUESTIONS

1. Determine the speed of a two-pole AC motor when the frequency of the current is 60 Hz.

   a. 450 r/min
   b. 900 r/min
   c. 1800 r/min
   d. 3600 r/min

2. How can an AC Drive be adapted for specific applications?

   a. by changing the default setting of the parameters.
   b. by setting the value of various parameters.
   c. by changing the FREQ. adjuster position.
   d. by selecting another AC Drive model.

3. What is the quick parameter selection used for?

   a. Rapidly selecting a parameter number.
   b. Rapidly changing from a parameter number to a parameter function.
   c. Rapidly changing from a parameter function to another.
   d. Rapidly selecting a parameter value.

4. What is the Initialization procedure used for?

   a. Store a special application setting.
   b. Prevent the operation with a parameter set to an unexpected value.
   c. Start the system rapidly.
   d. Reset the security parameters.

5. What happens when the Initialization procedure is completed?

   a. The AC Drive display shows d001.
   b. The value of all parameters is set to default setting.
   c. The AC Drive is set to the stop mode.
   d. All of the answers above are correct.

PARAMETER	FUNCTION	VALUE	DS
C021	*Multi-function output terminal P1 selection*	00: RUN (signal during RUN) 01: FA1 (constant speed arrival signal) 02: FA2 (over set frequency arrival signal) 03: OL (overload warning) 04: OD (excessive PID deviation) 05: AL (alarm output) 06: Dc (disconnection detection) 07: FBV (PID FB status output) 08: NDc (network error) 09: LOG (logic operation output) 10: ODc (Do not use.) 43: LOC (light load detection signal)	00

Table 1-13. Characteristics of parameter C021.

Procedure Summary

In the first part of this exercise, you will set the *Overload limit level* function, and observe that the AC Drive limits the output frequency when the current reaches the overload limit setting.

In the second part, you will observe that an overload signal can be produced to indicate an overload condition without stopping the motor.

In the last part, you will observe the effect of an overvoltage during deceleration.

EQUIPMENT REQUIRED

Refer to the Equipment Utilization Chart in Appendix A to obtain the list of equipment required for this exercise.

PROCEDURE

⚠ WARNING

The AC Power Supply provides high voltages. Do not change any AC connection with the power on.

Basic setup

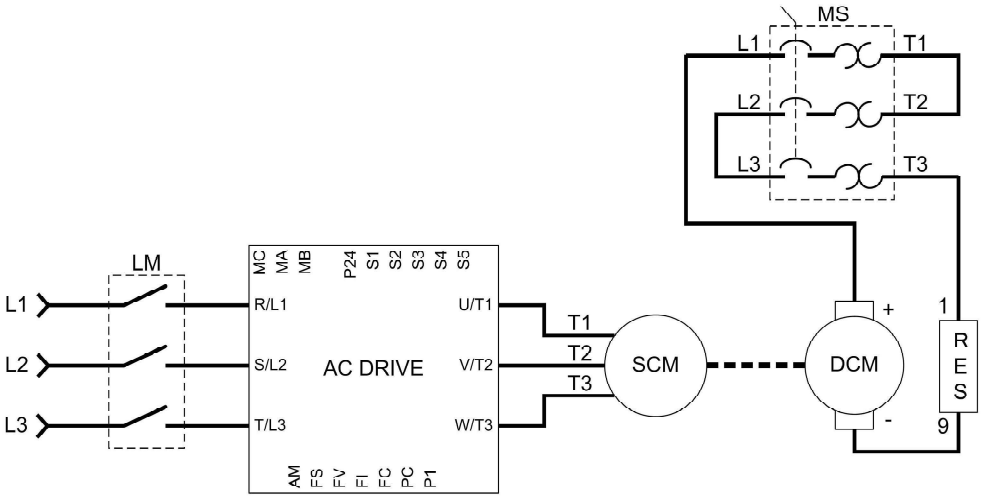
☐ 1. Perform the Basic Setup and Lockout/Tagout procedures.

Limiting motor current

☐ 2. Couple the DC Motor with the Brake Motor as described in Appendix F.

Note: *The DC Motor with the Starting Resistors module acts as load to the Brake Motor. Connect the resistors in series for maximum resistance.*

☐ 3. Set up the circuit shown in Figure 1-18.



LEGEND

AC DRIVE	=	THREE-PHASE AC DRIVE
DCM	=	DC MOTOR
LM	=	LOCKOUT MODULE
MS	=	MANUAL STARTER
RES	=	LOAD RESISTOR
SCM	=	SQUIRREL CAGE MOTOR

Figure 1-18. Circuit using the DC Motor with the Starting Resistors modules as load.

☐ 4. Manually disengage the friction brake.

Perform the Energizing procedure.

☐ 5. Set the parameters of the AC Drive as follows:

- Restore the default setting of the parameters by performing the Initialization procedure;
- Set the AC Drive to display the output current by selecting parameter d002;
- Turn the FREQ. adjuster fully clockwise.

☐ 6. Set the Manual Starter to the O position (without load).

Set the AC Drive to the run mode.

Enter the current value without load shown on the data display of the AC Drive after 10 seconds.

Current value without load: _____

☐ 7. Set the Manual Starter to the I position (with load).

Wait until the motor stabilizes, then enter the current value with load shown on the data display of the AC Drive.

Current value with load: _____

☐ 8. Set the AC Drive to the stop mode.

☐ 9. Read the default setting of the *Overload limit level*, parameter b022. Does this value correspond to 1.5 times the rated current (default setting of parameter C041)?

☐ Yes ☐ No

☐ 10. Referring to the current value with load you measured, how will the motor operation be affected by the *Overload limit level*, when this parameter (b022) is set to the default value? Explain.

_____

_____

☐ 11. Subtract 0.2 A from the current value with load you measured, and set the *Overload limit level* function, parameter b022, to the value obtained.

Set the *Overload limit parameter* function, parameter b023, to 5.0 s.

Set the *Overload limit selection* function, parameter b021, to 02 in order to disable the overload limit functions during the acceleration of the motor.

Set the AC Drive to display the output frequency by selecting parameter d001.

☐ 12. Set the Manual Starter to the O position (without load).

Set the AC Drive to the run mode.

Is the output frequency limited by the *Overload limit parameter*?

☐ Yes ☐ No

☐ 13. What will happen if the Manual Starter is set to the I position (with load) at this moment?

_____

_____

☐ 14. Set the Manual Starter to the I position (with load).

Does the frequency displayed by the data display on the AC Drive confirm your prediction?

☐ Yes ☐ No

☐ 15. Set the AC Drive to display the output current by selecting parameter d002.

Does the value correspond to the setting of the *Overload limit level* function (parameter b022)?

☐ Yes ☐ No

☐ 16. Set the AC Drive to display the output frequency by selecting parameter d001.

Set the Manual Starter to the O position (without load).

What happens to the frequency displayed by the AC Drive?

_____

_____

☐ 17. Set the AC Drive to the stop mode.

Set the *Overload limit level*, parameter b022, to the default setting.

Overload alarm signal

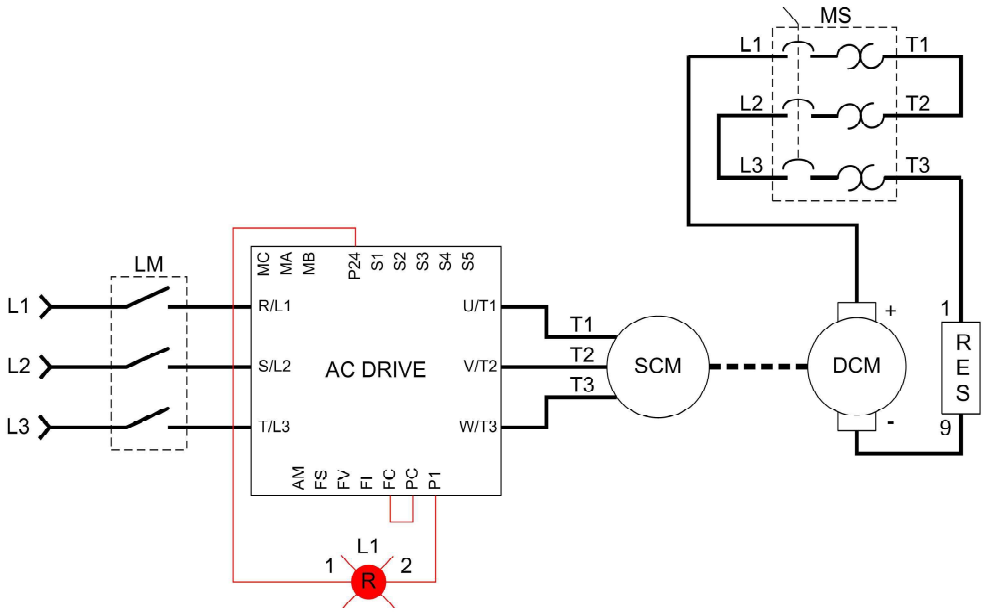
☐ 18. Modify your circuit to add a pilot light as shown in Figure 1-19.

☐ 19. Set the *Overload warning level* function, parameter C041, to the current value with load you measured earlier minus 0.2 A.

Set the *Multi-function output terminal P1 selection* function to OL (overload warning) by setting parameter C021 to 03.

Set the AC Drive to display the output current by selecting parameter d002.

☐ 20. Set the Manual Starter to the O position (without load).



LEGEND

AC DRIVE	=	THREE-PHASE AC DRIVE
DCM	=	DC MOTOR
L1	=	PILOT LIGHT #1 (RED)
LM	=	LOCKOUT MODULE
MS	=	MANUAL STARTER
RES	=	LOAD RESISTOR
SCM	=	SQUIRREL CAGE MOTOR

Figure 1-19. Circuit with a pilot light.

☐ 21. Set the AC Drive to the run mode, and wait for the motor to reach full speed before proceeding with the next step.

Does the pilot lamp turn on to indicate that the setting of the *Overload warning level* function has been reached?

☐ Yes ☐ No

☐ 22. Does the current value displayed by the AC Drive equal or exceed the setting of the *Overload warning level* function?

☐ Yes ☐ No

☐ 23. Set the Manual Starter to the I position (with load).

☐ 24. Does the pilot lamp turn on to indicate that the setting of the *Overload warning level* function has been exceeded?

☐ Yes ☐ No

☐ 25. Does the current value displayed by the AC Drive equal or exceed the *Overload warning level* setting?

☐ Yes ☐ No

☐ 26. Does the motor stop when the pilot lamp indicates that the setting of the *Overload warning level* function has been exceeded?

☐ Yes ☐ No

☐ 27. Set the AC Drive to the stop mode.

Set the *Overload warning level*, parameter C041, to the default setting.

Overvoltage during deceleration

☐ 28. Set the *Deceleration time* to 0.4 s by setting parameter F003 to 0.40.

☐ 29. Set the AC Drive to the run mode.

After a 10s delay, set the AC Drive to the stop mode. Describe what happens.

_____

_____

☐ 30. What is the meaning of the error code displayed by the AC Drive?

_____

_____

☐ 31. Set the AC Drive to the stop mode.

☐ 32. Turn the individual power switch of the AC Power Supply off, disconnect the circuit, and return the equipment to the storage location.

CONCLUSION

In this exercise, you observed that the AC Drive limits the output frequency to not exceed the *Overload limit level* setting. You saw that an overload signal can be produced to indicate an overload condition. You also observed the effect of an overvoltage during deceleration.

REVIEW QUESTIONS

1. How does the *Overload limit level* parameter limit the motor current?

   a. Stopping the motor
   b. Reducing the voltage
   c. Reducing the current
   d. Reducing the frequency

2. What parameter determines the level at which an overload alarm is output through a multi-function output?

   a. *Overload limit parameter*, parameter b023
   b. *Overload limit level*, parameter b022
   c. *Overload warning level*, parameter C041
   d. *Multi-function output terminal P1 selection*, parameter C021

3. Which error code is associated with an overvoltage during deceleration?

   a. E03
   b. E05
   c. E07
   d. E09

4. What can be done to prevent an overvoltage during deceleration?

   a. Increase the deceleration time
   c. Reduce the deceleration time
   c. Increase the acceleration time
   d. Reduce the acceleration time

⚠ WARNING

The AC Power Supply provides high voltages. Do not change any AC connection with the power on.

Basic setup

☐ 1. Perform the Basic Setup and Lockout/Tagout procedures.

Mechanical friction brake

☐ 2. Install the Brake Motor, Inertia Wheel, and Safety Guard.

☐ 3. Set up the circuit shown in Figure 1-22.

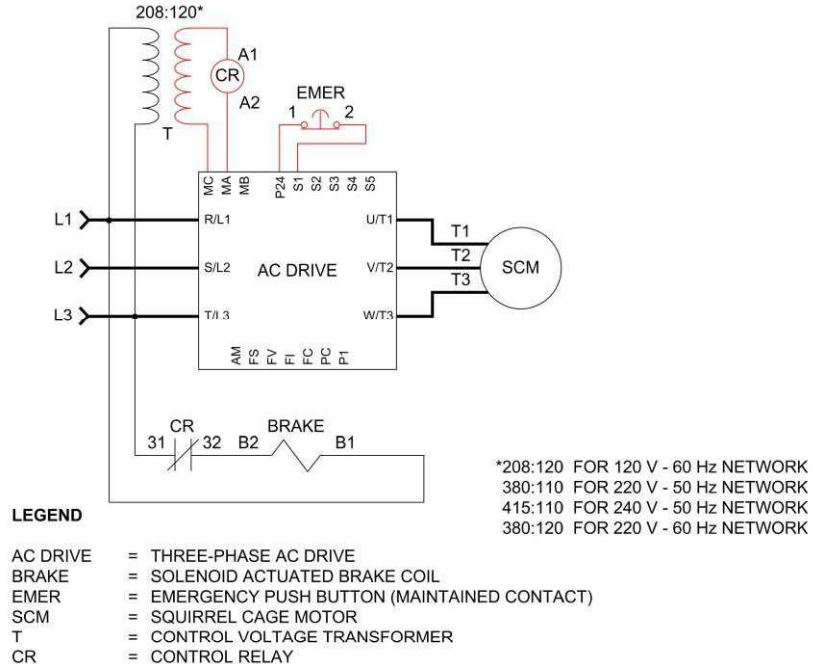


Figure 1-22. Circuit with emergency button and mechanical friction brake.

☐ 4. Press the Emergency Button.

Perform the Energizing procedure.

☐ 5. Set the parameters of the AC Drive as follows:

- Restore the default setting of the parameters by performing the Initialization procedure;
- Select *EXT (external trip)* for Multi-function input 1 by setting parameter C001 to 12;
- Select NC (normally closed) for Multi-function input 1 operation by setting parameter C011 to 01. This will cause Multi-function input 1 to trigger on low level signal. Since the Emergency Button is actuated, a fault signal should occur at this moment. This is because Multi-function input 1 detects a low level signal, indicating a fault condition. Release the Emergency Button to clear the fault condition;
- Press the STOP/RESET key to reset the fault signal;
- Turn the FREQ. adjuster fully clockwise;
- Set the AC Drive to the run mode.

☐ 6. Once the motor is rotating at full speed, press the Emergency Button.

Describe what happens, and explain why.

_____

_____

_____

☐ 7. Release the Emergency Button to clear the fault condition.

Set parameter PNU C001 to 00.

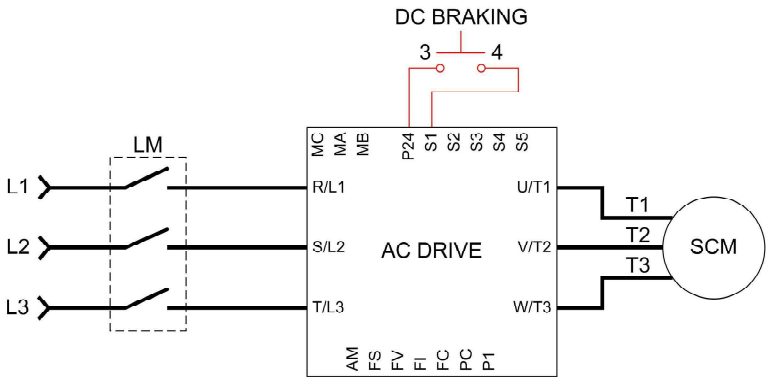
Restore the default setting of the parameters of the AC Drive by performing the Initialization procedure.

Turn off the Lockout Module.

Manually disengage the friction brake.

DC braking

☐ 8. Modify your circuit as shown in Figure 1-23.



LEGEND

AC DRIVE	=	THREE-PHASE AC DRIVE
DC BRAKING	=	DC BRAKING PUSH BUTTON (MOMENTARY CONTACT)
LM	=	LOCKOUT MODULE
SCM	=	SQUIRREL CAGE MOTOR

Figure 1-23. DC braking circuit.

☐ 9. Turn on the Lockout Module.

☐ 10. Set the parameters of the AC Drive as follows:

- Select *DB (external DC injection braking*) for Multi-function input 1 by setting parameter C001 to 07;
- Enable the *DC braking injection* by setting parameter A051 to 01;
- Set the *DC injection braking power* to 100% by setting parameter A054 to 100;
- Set the AC Drive to display the output frequency by selecting parameter d001.

☐ 11. Do not start the motor at this moment.

Remove the Safety Guard.

Do you feel the braking effect when you manually rotate the Inertia Wheel?

☐ Yes ☐ No

☐ 12. Press and hold the DC BRAKING push button to apply the DC braking.

Note: *If the ambient noise level in your laboratory is low, you might hear the high frequency noise generated by the DC braking.*

Do you feel the braking effect when you manually rotate the Inertia Wheel?

☐ Yes ☐ No

☐ 13. Is the DC braking effective in both directions of rotation?

☐ Yes ☐ No

☐ 14. Release the DC BRAKING push button.

Install the Safety Guard.

Set the AC Drive to the run mode. Turn the FREQ. adjuster of the AC Drive fully clockwise.

☐ 15. Wait for the motor to rotate at full speed.

Observe the AC Drive display as you press and hold the DC BRAKING push button.

How does the output frequency vary when the DC BRAKING push button is pressed?

_____

_____

☐ 16. Set the AC Drive to the run mode.

☐ 17. Wait for the motor to rotate at full speed.

Describe what happens when you press the DC BRAKING push button briefly and then release it.

_____

_____

☐ 18. Set the AC Drive to the stop mode.

☐ 19. Turn off the Lockout Module.

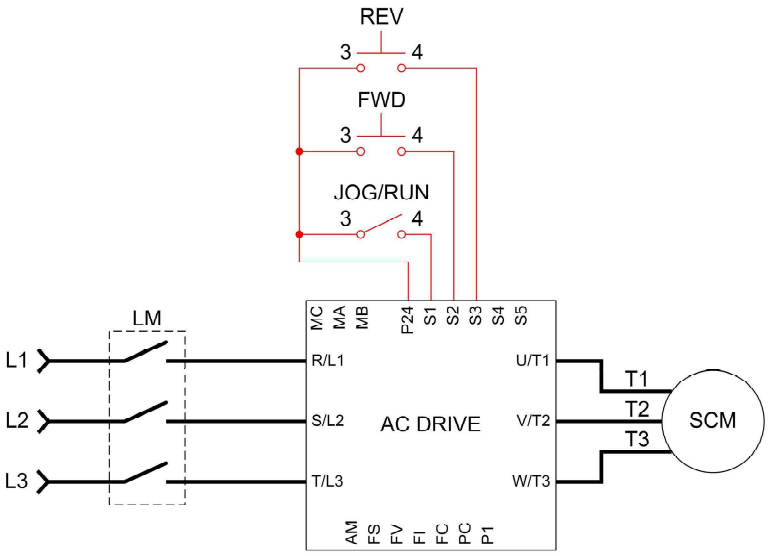
Jog mode

☐ 20. Set up the circuit shown in Figure 1-24.

☐ 21. Identify your circuit with magnetic labels, and turn on the Lockout Module.

☐ 22. Set the parameters of the AC Drive as follows:

- Restore the default setting of the parameters by performing the Initialization procedure;
- Select Terminal as *Run command selection* function by setting parameter A002 to 01;
- Select JG (jogging) as function for *Multi-function input 1* by setting parameter C001 to 06;
- Select FW (forward) as function for *Multi-function input 2* by setting parameter C002 to 00;
- Select RV (reverse) as function for *Multi-function input 3* by setting parameter C003 to 01;
- Set the *Jogging frequency* function to 8 Hz by setting parameter A038 to 8.00.



LEGEND

AC DRIVE	=	THREE-PHASE AC DRIVE
FWD	=	FORWARD PUSH BUTTON (MOMENTARY CONTACT)
JOG/RUN	=	JOG/RUN SELECTOR SWITCH (MAINTAINED CONTACT)
LM	=	LOCKOUT MODULE
REV	=	REVERSE PUSH BUTTON (MOMENTARY CONTACT)
SCM	=	SQUIRREL CAGE MOTOR

Figure 1-24. Jogging circuit.

☐ 23. Set the JOG/RUN selector of the Switches module to the RUN position (O).

Make sure that the FREQ. adjuster is turned fully clockwise.

Describe what happens when you press and hold the FWD push button of the Switches module.

_____

_____

☐ 24. Release the FWD push button.

Set the JOG/RUN selector to the JOG position (L).

Describe what happens when you press and hold the FWD push button.

_____

_____

☐ 25. Describe what happens when you release the FWD push button.

_____

_____

☐ 26. By which method does the motor stop?

☐ Free running (free coasting) ☐ Deceleration time ☐ DC Braking

☐ 27. Describe what happens when you press and hold the REV push button.

_____

_____

☐ 28. Does this correspond to the Jog mode of operation?

☐ Yes ☐ No

☐ 29. Set the AC Drive to the stop mode.

☐ 30. Turn the individual power switch of the AC Power Supply off, disconnect the circuit, and return the equipment to the storage location.

CONCLUSION

In this exercise, you set up a circuit using a friction brake controlled by an emergency button. You configured a multi-function input to trigger on a low level signal and you used a relay to control the motor-brake operation. You experienced DC braking, and observed that the braking is effective in both directions. In the last part you set the parameters of a jogging circuit.

REVIEW QUESTIONS

1. DC braking

   a. causes increased heat dissipation in the motor.
   b. consists in applying a pulsed DC voltage to the motor rotor.
   c. is suitable for holding loads.
   d. does not affect the output frequency.

2. In the circuit shown in Figure 1-24, what should be done to use a normally closed pushbutton instead of a normally open pushbutton as the REV push button?

   a. Multi-function input 2 must be configured to trigger on a high level signal.
   b. Multi-function input 2 must be configured to trigger on a low level signal.
   c. Multi-function input 3 must be configured to trigger on a high level signal.
   d. Multi-function input 3 must be configured to trigger on a low level signal.

3. What happens when the load rotates faster than the synchronous speed of the rotating stator field in deceleration mode?

   a. A fault signal will occur and the motor will continue to rotate.
   b. The motor becomes a three-phase generator and feeds voltage back into the drive.
   c. The load cannot rotate faster than the synchronous speed of the rotating stator field in deceleration mode.
   d. Nothing.

4. What is(are) the available braking method(s) in jog mode?

   a. free running (free coasting)
   b. deceleration time
   c. DC braking
   d. All of the answers above are correct.

5. Which parameter sets the rotation speed of the motor in jog mode?

   a. A038
   b. A039
   c. C001
   d. C011