# C  H  A  P  T  E  R  ③

# *Installation*

## Chapter Objectives

The information in this chapter will enable you to do the following:

❏  Mount all system components properly

❏  Connect all electrical system inputs and outputs properly

❏  Verify (test) system connections and operability

***Before you begin this chapter, complete all the steps and instructions discussed in Chapter ②.***

## Installation Precautions

To help ensure personal safely and long life of system components, pay special attention to the following installation precautions:

❏  Always remove power to the computer before doing the following:

  •  Installing or removing the OEMØ23-AT indexer board

  •  Connecting or disconnecting the cable harness

  •  Connecting or disconnecting system components

  •  Changing the indexer or adaptor box jumpers

❏  Make sure the indexer is operated in room temperatures between 32°F and 122°F (0°C to 50°C) and at a relative humidity between 0% and 90% (non-condensing).

## Installation Procedures

This section provides step-by-step procedures to install all standard components, optional components (VM50), and test the system.
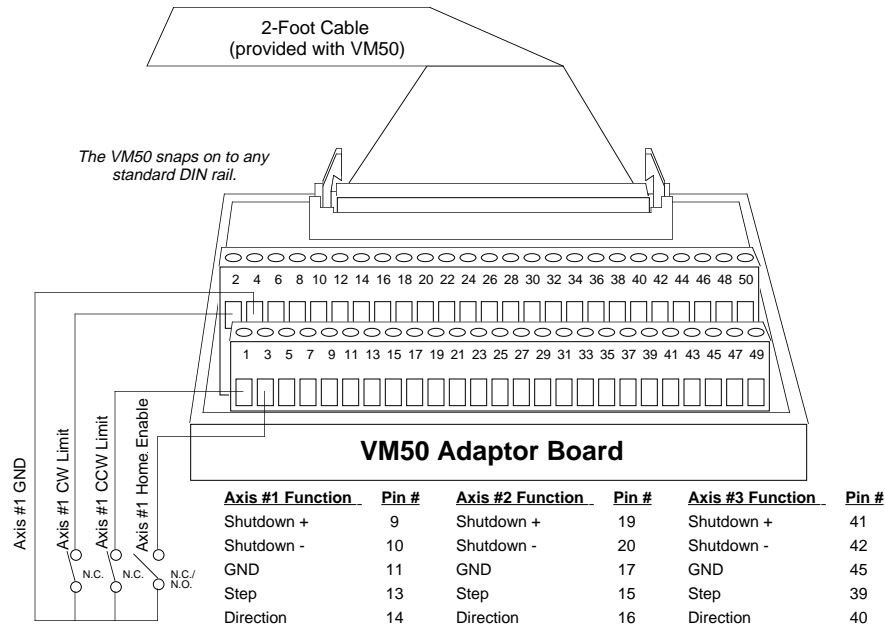
### ① Connect Motor Driver

Connect the drive to the VM50 connector as shown in *Chapter ② Getting Started.*

# ② **Make Auxiliary Connections**

There are three **AUXILIARY** connectors located on the VM50 adaptor box, one for each axis.  Refer to the table below for auxiliary connector pin assignments.  The following figure is a typical I/O wiring diagram for one axis.

☞ *Helpful Hint:*
The VM50 can be installed in any convenient location (within the length of the supplied cable).

2-Foot Cable
(provided with VM50)

*The VM50 snaps on to any standard DIN rail.*

2 4 6 8 10 12 14 16 18 20 22 24 26 28 30 32 34 36 38 40 42 44 46 48 50

1 3 5 7 9 11 13 15 17 19 21 23 25 27 29 31 33 35 37 39 41 43 45 47 49

### VM50 Adaptor Board

Axis #1 GND
Axis #1 CW Limit
Axis #1 CCW Limit
Axis #1 Home Enable
N.C.   N.C.   N.C./N.O.

| Axis #1 Function | Pin # | Axis #2 Function | Pin # | Axis #3 Function | Pin # |
|---|---|---|---|---|---|
| Shutdown + | 9 | Shutdown + | 19 | Shutdown + | 41 |
| Shutdown - | 10 | Shutdown - | 20 | Shutdown - | 42 |
| GND | 11 | GND | 17 | GND | 45 |
| Step | 13 | Step | 15 | Step | 39 |
| Direction | 14 | Direction | 16 | Direction | 40 |

**Programmable Output Connections**

The OEMØ23-AT has five programmable output bits (POBs—refer to previous table).  Using the Output (O) command, you can instruct the OEMØ23-AT to set these outputs high or low in the course of executing commands.  They are used to signal external equipment, or turn process-related devices on and off.  Refer to *Chapter ⑤ Hardware Reference*, for the output circuit configuration diagram.

*Electrical noise is usually caused by voltage spikes, not current.  Therefore, circuits designed to use these outputs in a current mode (rather than voltage signal mode) are less likely to experience electrical interference.*

**Input Connections**

Auxiliary inputs include six *trigger* inputs, a *home enable* input, and end-of-travel *CW and CCW limit* inputs.  Refer to *Chapter ⑤ Hardware Reference*, for the input circuit configuration diagram.  Inputs may be directly driven by voltage sources of ØV to 5V.  *Higher voltages will require the addition of external signal translators.*

Home Enable Input

Use the Home Enable input to establish a *home* position and return to that position when desired. The recommended way to use this input is to mount a normally-closed switch at a home reference position.  Connect the switch's positive lead to the Home Enable input, connect the negative lead to ground.  The home input polarity can be reversed with the OSC command.

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### CAUTION

Compumotor cannot guarantee proper homing performance with the home and end-of-travel limit inputs tied together.

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CW & CCW Limit Inputs

The CCW and CW end-of-travel limit inputs serve as safety stops that prevent the load from crashing into mechanical stops and damaging equipment or injuring personnel.  *Refer to the previous figure for unit wiring.*

Mount the switches such that the load forces them to open before it reaches the physical end-of-travel (**leave enough room for the load to stop**).  When the load opens the limit switch, the motor comes to a halt.  The motor will not be able to move in that same direction until the limit is cleared (switch closes).  The actual stopping distance depends on motor speed and the Limit Acceleration (LA) setting.

Use the `LD` command to disable or enable the limit inputs. Use the `RA` or `IS` commands to check the status of the limit switches.

*Trigger Inputs*  There are six trigger inputs. The trigger switches can be normally-open (not grounded) or normally-closed, depending on the `TR` command setting. The indexer can be programmed to wait until one or more inputs switch to a desired state (closed or open, 1 or Ø).

# Utility Commands

The utility commands below may be useful throughout this section while testing your OEMØ23-AT.

| Command | Description |
|---|---|
| `K` | Halts the motor immediately. The immediate deceleration may cause a loss of position. **This is a *panic* stop**. This command takes effect immediately after you issue it. |
| `S` | Decelerates the motor to a stop using the last defined acceleration value. The system executes this command immediately after you issue it. |
| `LD3` | Disables the limit switch functions. It allows motor motion with no limits connected. |
| `^H` | Instructs the OEMØ23-AT to backspace the cursor and delete the last character you entered (must be used prior to a delimiter). |
| `PS` | Instructs the indexer to pause. Buffered commands that follow the **PS** command are not executed until the indexer receives a Continue (**C**) command to clear the pause and resume execution. |

# ① Enter Terminal Emulation Mode

This system test uses the same terminal emulation mode used for the bench test you performed in *Chapter ② Getting Started*. Complete the following steps to enter the terminal emulation mode:

① From the OEMØ23-AT directory, type **OEM23TRM**.
② Enter device address **768** and answer **Y** (yes) to the reset question.

The OEMØ23-AT should now be in terminal emulation mode, ready to accept X language commands. Press **<F10>** at the end of this system test if you wish to exit the program.

# ② Test CW & CCW Limit Input Connections

Before you verify that the limit switches are working properly, check the following connections:

❑ Ensure that the CW and CCW limit switches are wired properly (normally closed switches that open when the load moves to the limit position).
❑ Make sure that the load is not attached to the motor.
❑ Make sure that you can manually open and close the limit switches.

Use the following procedure to test the limit input switches on axis #1 (repeat for each axis):

①    Open both CW and CCW switches.
②    Type `1IS`.  If all other inputs are opened, the response should be `1:001110`; this means that both CW and CCW limits (represented by $3^{rd}$ & $4^{th}$ digits) are opened.
③    Close the CW limit switch.
④    Type `1IS`.  Assuming all other inputs are open, the response to this command should be `1:000110`.
⑤    Close the CCW limit switch.
⑥    Type `1IS`.  The response should be `1:000010`.
⑦    To test the CW limit switch, enter the following string of commands:

| Command | Description |
| --- | --- |
| `LD0` | Enables CW and CCW limits |
| `MC` | Sets indexer to continuous mode |
| `LA10` | When limit is encountered motor decelerates at 10 rps$^2$ |
| `A5` | Sets acceleration to 5 rps$^2$ |
| `V2` | Sets velocity to 2 rps |
| `H+` | Sets motor direction (+ = CW) |
| `G` | Executes the move (G0) |

The motor should move at a constant velocity.

⑧    Open the CW limit switch.  The motor should come to a stop at 10 rps$^2$.

⑨    To test the CCW limit switch, enter the following string of commands:

☞ *Helpful Hint:*
The motor should move at a constant velocity.

| Command | Description |
| --- | --- |
| `MC` | Sets indexer to Continuous mode |
| `A1` | Sets acceleration to 1 rps$^2$ |
| `V1` | Sets velocity to 1 rps |
| `H-` | Sets move to the CCW direction |
| `G` | Executes the move (Go) |

⑩    Open the CCW limit switch.  The motor should come to a stop at 10 rps$^2$.

If the motor continues to move, open the CW limit switch.  If the motor stops when you open the CW limit switch, swap the CW and CCW limit input wires.  If neither of these limit switches stop the motor, recheck your switch wiring and refer to *Chapter ⑥ Troubleshooting*.

## ③ Test Trigger Input Connections

The six trigger inputs are typically connected to sensors or other signal sources to provide the indexer with information on external conditions.  The indexer can be programmed to wait until one or more inputs switch to a desired state (on or off, 1 or Ø).  The `TR` command causes a pause in the execution of buffered commands if one or more trigger inputs are not in the state specified by the command.  The `TS` command reports the state of all six trigger inputs.

Use the following steps to verify that the trigger inputs are wired properly.

①    Type `1TS`.  If all the trigger inputs are open (not grounded), the response should be `1:000000`.
②    Close the TRIG 1 input switch.
③    Type `1TS`.  The response should be `1:100000`.  This verifies that the TRIG 1 input is closed.

Repeat steps ① through ③ for each trigger input.

④    Enter the following commands:

| Command | Description |
| --- | --- |
| `MN` | Sets indexer to normal mode |
| `A2` | Sets acceleration to 2 rps$^2$ |
| `V2` | Sets velocity to 2 rps |
| `D25000` | Sets distance to 25,000 steps |
| `TR1XXXXX` | Wait for Trigger Input 1 to be grounded |
| `G` | Executes the move (Go) |

⑤    Ground trigger input 1 (motor will move).

# ④ Test POB Connections

The OEMØ23-AT is equipped with five programmable output bits.  You may use them to signal a peripheral device that the OEMØ23-AT has just completed some event.  These outputs are controlled with the `O` or `IO` commands.

Perform the following steps to verify that you have wired the outputs properly:

① Type `O11111`

The response from this command should be 5VDC, as measured between the POB and ground.

② You may change the reading between the POB and ground to logic low (ØVDC) by entering the following command:  `OØØØØØ`

# ⑤ Test the Homing Function

This section provides procedures to test the home switch and the homing function.  Homing uses only the home switch to establish the home reference position.

**Test the Home Switch**

Before testing the homing function, you should use the following procedure to test whether you have connected the home switch properly:

① Assuming the switch is normally-closed, manually open the switch and type `1IS`.  Assuming your end-of-travel limit switches are closed and all other inputs are open (not grounded), the response will be `1:ØØØØ1Ø`.  The $5^{th}$ digit in the response represents the home input status.

② Close the home switch and type `1IS`. The response should be `1:ØØØØØØ`.  This verifies that the switch is connected properly.

**Go Home Process**

① To initiate the homing function, you must issue the Go Home  (`GH`) command.  When you issue the Go Home command, you must include the direction and velocity that the motor should use to search for home.  You may also specify the Go Home acceleration with the `GA` command.

② After you issue the `GH` command, the motor begins to move in the direction and at the velocity and acceleration that you specified.  The OEMØ23-AT waits for the home limit input to go active (usually activated by the load opening a normally-closed home switch).  If the motor trips an end-of-travel limit switch while it searches for home, it will reverse direction and look for the home limit input to go active.  If the motor trips the other limit switch before it detects the home signal, the Go Home move will be aborted and the motor will stop.

③ While the motor (and load) is moving, the OEMØ23-AT recognizes the *home position* as the position where the home limit signal makes a transition from ON to OFF, or from OFF to ON, depending on if the `OSC` setting is *active high* or *active low* (default is *active high*, home = transition from ON to OFF).

④ The motor decelerates to a stop.

⑤ The motor changes direction, passes the home position, and stops 1/32 of a revolution on the opposite side of the home position.

⑥ The OEMØ23-AT then changes motor direction again and creeps the motor at 0.1 rps  until it reaches the home position.

⑦ When the homing operation is complete, the indexer automatically resets its internal absolute position counter for that axis to zero (same as issuing `PZ`).

You can verify if the homing process was successful by issuing the Go Home Status (`RC`) command.

You must ensure that the final approach (step ④ above) is in the same direction you wish the motor to move after the homing function is complete.  If the desired post-homing direction is CW, the 0.1 rps creep portion of the go home move must start from the CCW side of home.  If there is significant *backlash* in the system, and the indexer is instructed to go home in the CW direction, the motor may end up on the wrong side of the home signal and execute its final approach in the wrong direction.

There are two situations in which the OEMØ23-AT can lose track of the *home* position.  They are (1), *overshoot* resulting from a Go Home velocity that is too high, and (2), a mechanical or electrical home switch signal delay. In such situations, you should reduce the Go Home velocity.

**Test Homing**    Use the following procedure to test the homing function:

① Issue the following commands:

| Command | Description |
|---------|-------------|
| LDØ | Enable the CW and CCW limits |
| GA5 | Sets go home acceleration to 5 rps$^2$ |
| GH+2 | Instructs the motor to go home (CW) at 2 rps |

The motor should move CW at a constant velocity of 2 rps.  When the load opens the home switch (***if the motor is not connected to the load, you must manually open and close the switch***), the motor decelerates to a stop.  The motor changes direction, travels CCW past the home position, and stops.  The motor changes direction again and creeps CW at 0.1 rps and stops at the home position (***or when you manually open and close the home switch again***).

② Issue the **1PR** command to verify that the homing is complete and that the absolution position counter is reset to zero.  The response should be **1:+ØØØØØØØØ**.

③ Issue the **1RC** command to verify that the homing was successful.  The response should be **1:*@**.