

ZABER

NM Product
User's Manual
Firmware 5.00 and up

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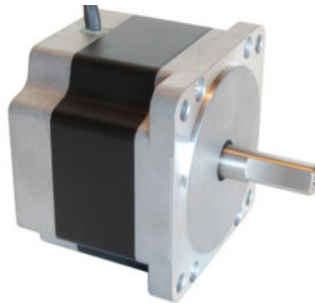


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Disclaimer

Zaber's devices are not intended for use in any critical medical, aviation, or military applications or situations where a product's use or failure could cause personal injury, death, or damage to property. Zaber disclaims any and all liability for injury or other damages resulting from the use of our products.

Conventions used throughout this document

- `Fixed width` type indicates communication to and from a device. The `\r` symbol indicates a carriage return, which can be achieved by pressing enter when using a terminal program.
- An ASCII command followed by (T:xx) indicates a legacy T-Series Binary Protocol command that achieves the same result. Not all ASCII commands have an equivalent legacy counterpart. e.g.:
`move abs 10000 (T:20:10000)` shows that a move abs ASCII command can also be achieved with binary command number 20.
- All devices support the Binary Protocol, however the ASCII Protocol is only supported in devices with firmware version (T:51) 6.06 and above.

Precautions

- Always check the controller settings before connecting the motor to a new controller. An incorrect current supply may damage the device.
- Do not attempt to plug or unplug the home sensor while the Zaber device is powered. This could result in damage to the device. Always disconnect power before attempting to install or uninstall the home sensor cable.

Noise Levels

Please note that the following motors will produce significant noise levels while holding a static position. Setting the driver hold current to 0 will reduce the noise but also eliminate any holding torque.

- NM34C20S-T4
- NM34C20D-T4

Installation

You can mount the NM motors by the four mounting holes on the motor face. These conform to the NEMA ICS 16 standard. See the [NM-T4 product page](#) for specific motor dimensions. Always set up the controller before connecting the motor. Refer to the controller's user manual for more information on controller installation and operation.

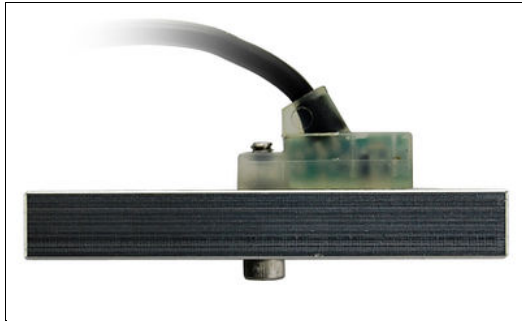
Be sure that the home sensor is mounted to a fixed part and the magnet to a moving part. Also take care that negative motion of the motor (ex a negative relative move, negative constant speed move, or counterclockwise turn of the manual control knob) brings the magnet closer to the home sensor.

The NM-T4 home sensor can be mounted either in a T-slot, using the pre-installed set screw, or to a flat surface with the included fastener as shown below. The home sensor is equipped with a red LED which will indicate triggering. Connecting to a powered controller and watching the LED can simplify the process of aligning the home sensor with the path of the magnet. Recommended T-slot dimensions and the region of magnetic sensitivity are shown in the [hall sensor dimensional drawing](#).

Home Sensor

The purpose of the home sensor is to set a reference or zero position to synchronize the controllers internal position with the physical device position. On power-up, the default reference position assumed by the controller is typically the maximum range setting. The home sensor is a Hall effect switch which plugs into the motion control device. A small magnet (included) activates the Hall effect switch when it approaches within roughly 2 mm of the face. The range of the sensor will be affected by nearby ferromagnetic material, such as steel fasteners as well as the polarity of the magnet. The home sensor will be more sensitive facing the south pole of the magnet.

Most Zaber positioning products have built-in Hall effect home sensors. However, on the NM and NM-T4 devices, the home sensor is detachable. If the home sensor is connected, a home (T:1) instruction may be issued at any time to zero the device. In certain applications (for example continuous rotation at controlled velocities), position synchronization isn't required, and the home sensor may not need to be installed. If you choose not to install the home sensor then do not issue the home instruction. If you do, the motor will reverse indefinitely, waiting for the home sensor to be triggered. It is recommended to always set a reference position, by issuing the home instruction, or if the home sensor is not installed, by manually setting the initial position through the pos (T:45) setting. Note that if the position is not set manually or the device is not homed, the device will remain in unhomed mode and move at the slower of limit.approach.maxspeed (T:41) or maxspeed (T:42) during position move commands.

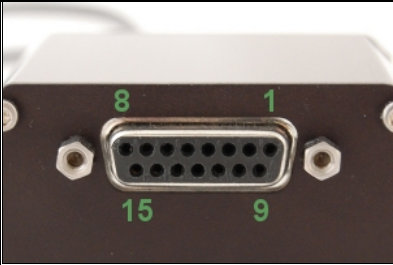
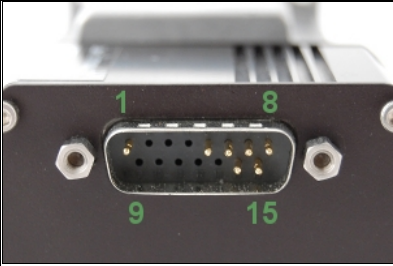
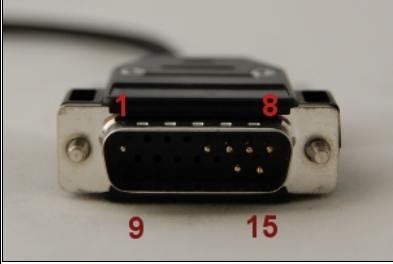


Operation

The NM-T4 is designed to be controlled with any of Zaber's X-Series or A-Series [Stepper Motor Controllers](#). The older NM is designed to be controlled with the [T-MCA](#) series controller. Zaber's controllers and peripherals are designed for ease of use when used together. Optimal settings for each peripheral (such as the default current, speed, acceleration, and limit settings) can be loaded by setting the [peripheralid](#) (T:66) on the controller. The peripheral ID is listed as the ID on the peripheral's label. A list of IDs is also available on the [ID Mapping](#) page. For more information on device operation, refer to the controller's user manual.

For reference, the pinout for the motor cable connectors is shown below:

Pinout for D-sub 15 Connectors (A-series and X-Series controllers and peripherals)

A- or X-series controller (female)	
T3 Peripheral (male)	
T4 Peripheral (male)	

Pin #	Function
1	+5V
2	Encoder Error ****
3	<i>reserved</i>
4	Away Sensor ***
5	Home Sensor
6	Ground
7	Motor B1
8	Motor A1
9	+5V *

10	Encoder A *
11	Encoder B *
12	Encoder Index **
13	Ground *
14	Motor B2
15	Motor A2

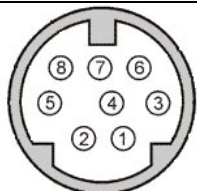
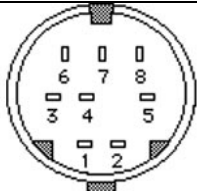
* *encoder embedded peripherals only*

** *devices with encoders with index only*

*** *devices with away sensors only*

**** *devices with linear or direct-reading encoders only*

Pin-Out for Minidin 8 (T-MCA connector and CDC6 cable to Peripheral)

Minidin 8 Female (on T-MCA)	Minidin 8 Male (on Peripheral)
	

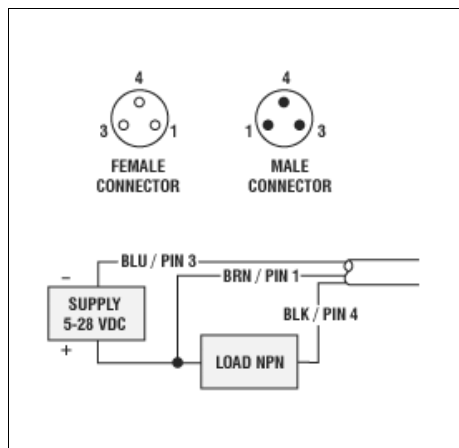
Pin #	Function
1	Motor A1
2	Motor A2
3	Motor B1
4	Not Connected
5	Motor B2
6	+5V
7	Home Signal
8	Ground

Alternate Controllers

The device may be controlled by any 2-phase stepper motor controller with home sensor input. **Warning:** Operating the unit without correctly wiring up the home sensor can cause permanent damage to the unit. We do not recommend using your own controller unless you are familiar with how to control a stepper motor with a hall sensor limit switch. The following information is provided for reference only. Damage to the actuator or hall sensor due to incorrect wiring is not covered by warranty.

NM-T4 Home Sensor Wiring

Your controller should be configured so the stage stops immediately (little deceleration) when the home sensor is triggered. The Hall sensor has an open-collector output. The default output is high impedance when the Hall sensor is not active. When the sensor detects a magnet, the Hall sensor pulls the output low to ground.

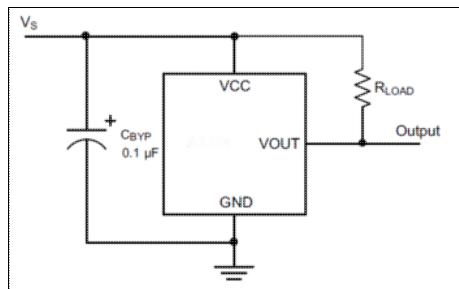


NM Home Sensor Wiring

A Hall effect sensor is mounted in the device for use as a home sensor. It is part number A1122LUA-T made by Allegro. [Click here for data sheet](#). Your controller should be configured so the stage stops immediately (little deceleration) when the home sensor is triggered.

- Wire colour code:
 - ◆ 3.6-24 Vdc input - red
 - ◆ Home signal - yellow
 - ◆ Ground - black

The Hall sensor has an open-collector output. The default output is high impedance when the Hall sensor is not active. When the sensor detects a magnet, the Hall sensor pulls the output low to ground.



If you are not using a Zaber controller, ensure that your controller has a pull-up resistor on the output line of the Hall sensor as shown in the diagram. The bypass capacitor is optional, but may help to eliminate false triggering in noisy environments. The typical value for the pull-up resistor (R_{LOAD}) is 10k and for the bypass capacitor is 0.1μF to 1μF. The larger the capacitance, the better the noise filtering but the slower the response time.

Warranty and Repair

For Zaber's policies on warranty and repair, please refer to the [Ordering Policies](#)

Standard products

Standard products are any part numbers that do not contain the suffix ENG followed by a 4 digit number. Most, but not all, standard products are listed for sale on our website. All standard Zaber products are backed by a one-month satisfaction guarantee. If you are not satisfied with your purchase, we will refund your payment minus any shipping charges. Goods must be in brand new saleable condition with no marks. Zaber products are guaranteed for one year. During this period Zaber will repair any products with faults due to manufacturing defects, free of charge.

Custom products

Custom products are any part numbers containing the suffix ENG followed by a 4 digit number. Each of these products has been designed for a custom application for a particular customer. Custom products are guaranteed for one year, unless explicitly stated otherwise. During this period Zaber will repair any products with faults due to manufacturing defects, free of charge.

How to return products

Customers with devices in need of return or repair should contact Zaber to obtain an RMA form which must be filled out and sent back to us to receive an RMA number. The RMA form contains instructions for packing and returning the device. The specified RMA number must be included on the shipment to ensure timely processing.

Email Updates

If you would like to receive our periodic email newsletter including product updates and promotions, please sign up online at www.zaber.com ([news section](#)). Newsletters typically include a promotional offer worth at least \$100.

Contact Information

Contact Zaber Technologies Inc by any of the following methods:

Phone	1-604-569-3780 (direct) 1-888-276-8033 (toll free in North America)
Fax	1-604-648-8033
Mail	#2 - 605 West Kent Ave. N., Vancouver, British Columbia, Canada, V6P 6T7
Web	www.zaber.com
Email	Please visit our website for up to date email contact information.

The original instructions for this product are available at <http://www.zaber.com/wiki/Manuals/NM>.

Specification	Value	Alternate Unit
<u>Microstep Size (Default Resolution)</u>	0.028125 degrees	490.866 urad
<u>Integrated Controller</u>	No	
<u>Minimum Speed</u>	0.1318 deg/s	2,300.305 urad/s
<u>Speed Resolution</u>	0.1318 deg/s	
<u>Encoder Type</u>	None	
<u>Motor Steps Per Rev</u>	200	
<u>Motor Type</u>	Stepper (2 phase)	
<u>Motor Connection</u>	D-sub 15	
<u>Limit or Home Sensing</u>	Magnetic home sensor	
<u>Vacuum Compatible</u>	No	
<u>Operating Temperature Range</u>	0 to 75 degrees C	
<u>RoHS Compliant</u>	Yes	
<u>CE Compliant</u>	Yes	

Comparison - NM Series

Part Number	Recommended Controller	Maximum Speed	Maximum Torque	Motor Rated Current
<u>NM08AD-T4</u>	<u>X-MCB1</u> (24 V) Recommended	14600 deg/s (2,433.4 rpm)	1.7 N-cm (2.4 oz-in)	600 mA/phase
<u>NM08AS-T4</u>	<u>X-MCB1</u> (24 V) Recommended	14600 deg/s (2,433.4 rpm)	1.7 N-cm (2.4 oz-in)	600 mA/phase
<u>NM08BD-T4</u>	<u>X-MCB1</u> (24 V) Recommended	14600 deg/s (2,433.4 rpm)	2.3 N-cm (3.3 oz-in)	800 mA/phase
<u>NM08BS-T4</u>	<u>X-MCB1</u> (24 V) Recommended	14600 deg/s (2,433.4 rpm)	2.3 N-cm (3.3 oz-in)	800 mA/phase
<u>NM11AD-T4</u>	<u>X-MCB1</u> (24 V) Recommended	14600 deg/s (2,433.4 rpm)	5.0 N-cm (7.1 oz-in)	670 mA/phase
<u>NM11AS-T4</u>	<u>X-MCB1</u> (24 V) Recommended	14600 deg/s (2,433.4 rpm)	5.0 N-cm (7.1 oz-in)	670 mA/phase
<u>NM11CD-T4</u>	<u>X-MCB1</u> (24 V) Recommended	14600 deg/s (2,433.4 rpm)	8.6 N-cm (12.2 oz-in)	670 mA/phase

<u>NM11CS-T4</u>	<u>X-MCB1</u> (24 V) Recommended	14600 deg/s (2,433.4 rpm)	8.6 N-cm (12.2 oz-in)	670 mA/phase
<u>NM17AD-T4</u>	<u>X-MCB1</u> (48 V) Recommended	14600 deg/s (2,433.4 rpm)	14.4 N-cm (20.4 oz-in)	670 mA/phase
<u>NM17AS-T4</u>	<u>X-MCB1</u> (48 V) Recommended	14600 deg/s (2,433.4 rpm)	14.4 N-cm (20.4 oz-in)	670 mA/phase
<u>NM17CD-T4</u>	<u>X-MCB1</u> (48 V) Recommended	8030 deg/s (1,338.4 rpm)	25.2 N-cm (35.7 oz-in)	850 mA/phase
<u>NM17CS-T4</u>	<u>X-MCB1</u> (48 V) Recommended	8030 deg/s (1,338.4 rpm)	25.2 N-cm (35.7 oz-in)	850 mA/phase
<u>NM23AD-T4</u>	<u>X-MCB1</u> (48 V) Recommended	8030 deg/s (1,338.4 rpm)	32.4 N-cm (45.9 oz-in)	710 mA/phase
<u>NM23AS-T4</u>	<u>X-MCB1</u> (48 V) Recommended	8030 deg/s (1,338.4 rpm)	32.4 N-cm (45.9 oz-in)	710 mA/phase
<u>NM23CD-T4</u>	<u>X-MCB1</u> (48 V) Recommended	5110 deg/s (851.7 rpm)	117.9 N-cm (167.0 oz-in)	710 mA/phase
<u>NM23CS-T4</u>	<u>X-MCB1</u> (48 V) Recommended	5110 deg/s (851.7 rpm)	117.9 N-cm (167.0 oz-in)	710 mA/phase
<u>NM34AD-T4</u>	<u>X-MCB1</u> (48 V) Recommended	6570 deg/s (1,095.0 rpm)	196.2 N-cm (277.8 oz-in)	1400 mA/phase
<u>NM34AS-T4</u>	<u>X-MCB1</u> (48 V) Recommended	6570 deg/s (1,095.0 rpm)	196.2 N-cm (277.8 oz-in)	1400 mA/phase
<u>NM34CD-T4</u>	<u>X-MCB1</u> (48 V) Recommended	1020 deg/s (170.0 rpm)	557.1 N-cm (788.9 oz-in)	1400 mA/phase
<u>NM34CS-T4</u>	<u>X-MCB1</u> (48 V) Recommended	1020 deg/s (170.0 rpm)	557.1 N-cm (788.9 oz-in)	1400 mA/phase
<u>Part Number</u>	<u>Motor Winding Resistance</u>	<u>Inductance</u>	<u>Motor Rated Power</u>	<u>Motor Rotor Inertia</u>
<u>NM08AD-T4</u>	6.5 ohms/phase	1.7 mH/phase	4.7 Watts	2 g-cm ²
<u>NM08AS-T4</u>	6.5 ohms/phase	1.7 mH/phase	4.7 Watts	2 g-cm ²
<u>NM08BD-T4</u>	5.4 ohms/phase	1.5 mH/phase	6.9 Watts	2 g-cm ²
<u>NM08BS-T4</u>	5.4 ohms/phase	1.5 mH/phase	6.9 Watts	2 g-cm ²
<u>NM11AD-T4</u>	5.6 ohms/phase	4.0 mH/phase	5 Watts	9 g-cm ²

<u>NM11AS-T4</u>	5.6 ohms/phase	4.0 mH/phase	5 Watts	9 g-cm ²
<u>NM11CD-T4</u>	9.2 ohms/phase	5.6 mH/phase	8.3 Watts	18 g-cm ²
<u>NM11CS-T4</u>	9.2 ohms/phase	5.6 mH/phase	8.3 Watts	18 g-cm ²
<u>NM17AD-T4</u>	8.4 ohms/phase	10.0 mH/phase	7.6 Watts	35 g-cm ²
<u>NM17AS-T4</u>	8.4 ohms/phase	10.0 mH/phase	7.6 Watts	35 g-cm ²
<u>NM17CD-T4</u>	6.6 ohms/phase	11.2 mH/phase	9.6 Watts	68 g-cm ²
<u>NM17CS-T4</u>	6.6 ohms/phase	11.2 mH/phase	9.6 Watts	68 g-cm ²
<u>NM23AD-T4</u>	11.4 ohms/phase	21.6 mH/phase	11.4 Watts	120 g-cm ²
<u>NM23AS-T4</u>	11.4 ohms/phase	21.6 mH/phase	11.4 Watts	120 g-cm ²
<u>NM23CD-T4</u>	17.2 ohms/phase	56.0 mH/phase	17.2 Watts	475 g-cm ²
<u>NM23CS-T4</u>	17.2 ohms/phase	56.0 mH/phase	17.2 Watts	475 g-cm ²
<u>NM34AD-T4</u>	4.4 ohms/phase	30.8 mH/phase	17.6 Watts	1400 g-cm ²
<u>NM34AS-T4</u>	4.4 ohms/phase	30.8 mH/phase	17.6 Watts	1400 g-cm ²
<u>NM34CD-T4</u>	7.6 ohms/phase	76.8 mH/phase	30.4 Watts	4000 g-cm ²
<u>NM34CS-T4</u>	7.6 ohms/phase	76.8 mH/phase	30.4 Watts	4000 g-cm ²

<u>Part Number</u>	<u>Motor Frame Size</u>	<u>Motor Shaft Style</u>	<u>Motor Shaft Diameter</u>	<u>Mounting Interface</u>
<u>NM08AD-T4</u>	08	Double	4 mm (0.157 ")	4 M2 tapped holes 16 mm apart
<u>NM08AS-T4</u>	08	Single	4 mm (0.157 ")	4 M2 tapped holes 16 mm apart
<u>NM08BD-T4</u>	08	Double	4 mm (0.157 ")	4 M2 tapped holes 16 mm apart
<u>NM08BS-T4</u>	08	Single	4 mm (0.157 ")	4 M2 tapped holes 16 mm apart
<u>NM11AD-T4</u>	11	Double	5 mm (0.197 ")	4 M2.5 tapped holes 23 mm apart
<u>NM11AS-T4</u>	11	Single	5 mm (0.197 ")	4 M2.5 tapped holes 23 mm apart
<u>NM11CD-T4</u>	11	Double	5 mm (0.197 ")	4 M2.5 tapped holes 23 mm apart
<u>NM11CS-T4</u>	11	Single		4 M2.5 tapped holes 23 mm apart

			5 mm (0.197 ")	
<u>NM17AD-T4</u>	17	Double	5 mm (0.197 ")	4 #4-40 tapped holes 31 mm apart
<u>NM17AS-T4</u>	17	Single	5 mm (0.197 ")	4 #4-40 tapped holes 31 mm apart
<u>NM17CD-T4</u>	17	Double	5 mm (0.197 ")	4 #4-40 tapped holes 31 mm apart
<u>NM17CS-T4</u>	17	Single	5 mm (0.197 ")	4 #4-40 tapped holes 31 mm apart
<u>NM23AD-T4</u>	23	Double	6.35 mm (0.250 ")	4 holes 4.75 mm dia 47.14 mm apart
<u>NM23AS-T4</u>	23	Single	6.35 mm (0.250 ")	4 holes 4.75 mm dia 47.14 mm apart
<u>NM23CD-T4</u>	23	Double	6.35 mm (0.250 ")	4 holes 4.75 mm dia 47.14 mm apart
<u>NM23CS-T4</u>	23	Single	6.35 mm (0.250 ")	4 holes 4.75 mm dia 47.14 mm apart
<u>NM34AD-T4</u>	34	Double	12.7 mm (0.500 ")	4 holes 6.5 mm dia 69.58 mm apart
<u>NM34AS-T4</u>	34	Single	12.7 mm (0.500 ")	4 holes 6.5 mm dia 69.58 mm apart
<u>NM34CD-T4</u>	34	Double	12.7 mm (0.500 ")	4 holes 6.5 mm dia 69.58 mm apart
<u>NM34CS-T4</u>	34	Single	12.7 mm (0.500 ")	4 holes 6.5 mm dia 69.58 mm apart

Part Number Weight

<u>NM08AD-T4</u>	0.07 kg
<u>NM08AS-T4</u>	0.07 kg
<u>NM08BD-T4</u>	0.07 kg
<u>NM08BS-T4</u>	0.07 kg
<u>NM11AD-T4</u>	0.12 kg

<u>NM11AS-T4</u>	0.12 kg
<u>NM11CD-T4</u>	0.21 kg
<u>NM11CS-T4</u>	0.21 kg
<u>NM17AD-T4</u>	0.22 kg
<u>NM17AS-T4</u>	0.22 kg
<u>NM17CD-T4</u>	0.36 kg
<u>NM17CS-T4</u>	0.36 kg
<u>NM23AD-T4</u>	0.46 kg
<u>NM23AS-T4</u>	0.46 kg
<u>NM23CD-T4</u>	1.01 kg
<u>NM23CS-T4</u>	1.01 kg
<u>NM34AD-T4</u>	1.71 kg
<u>NM34AS-T4</u>	1.71 kg
<u>NM34CD-T4</u>	3.81 kg
<u>NM34CS-T4</u>	3.81 kg