

DMX-K-DRV

Integrated Step Motor Driver + (Basic Controller) Manual



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- 1.00 – 1st release
- 1.29 – 2nd release
- 1.30 – 3rd release
- 1.32 – 4th release
- 1.33 – 5th release

Firmware Compatibility:

†V29

†If your module's firmware version number is less than the listed value, contact Arcus for the appropriate documentation.

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1. Introduction

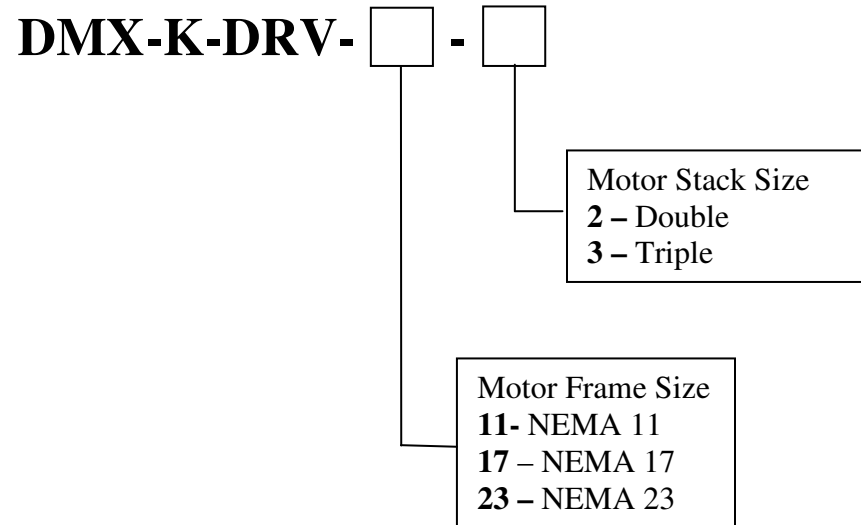
DMX-K-DRV is an integrated stepper driver and motor product. Feature highlights include: simple controller functionality (NEMA 17/23 only) and over temperature alarm output.

Features

DMX-K-DRV

- 12-24VDC voltage input
- 100mA to 2.5A peak current setting
- Full/Half/Quarter/16 microstep
- One clock (Pulse/Dir) or Two clock (CW/CCW) support
- 200K maximum pulse rate support
- 16K maximum pulse rate (controller mode)
- 4 selectable motion profiles (controller mode)
- Opto-isolated differential Pulse/Dir (CW/CCW) inputs
- Opto-isolated driver enable input
- Opto-isolated over-temperature alarm output
 - In position output (controller mode)
- Integrated controller using DIO control (NEMA 17/23 only)
- Available in NEMA 11, 17, and 23 motors in various stack sizes.

2. Part Numbering Scheme



Notes:

- Standard sizes available for NEMA 11 are double and triple.
- Standard sizes available for NEMA 17 are double and triple.
- Standard sizes available for NEMA 23 are double and triple.

3. Electrical and Thermal Specifications

Power Requirement

Regulated Voltage:	+12 to +24 VDC
Recommended Supply Current:	2.5 A (RMS) †

† The supply current should match the driver current setting.

Temperature Ratings †

Operating Temperature:	-20°C to +85°C
Storage Temperature:	-55°C to +150°C

† Based on component ratings

4. Dimensions

DMX-K-DRV-11

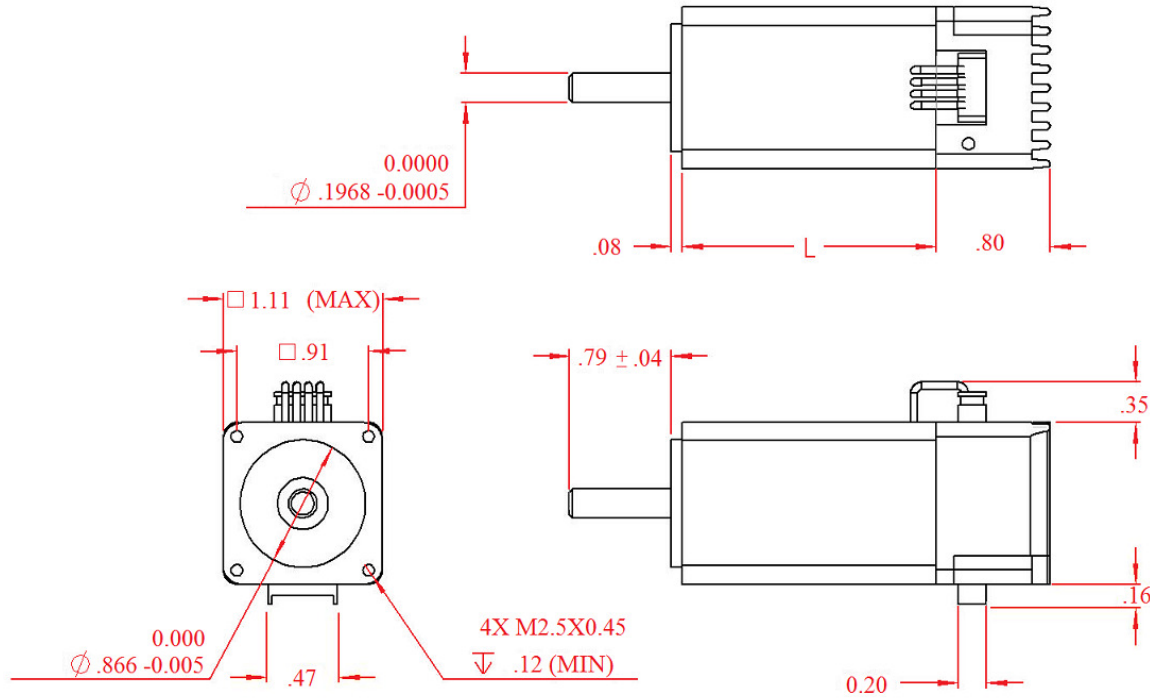


Figure 4.0

NEMA 11 Models	L (inches)
DMX-K-DRV-11-2 (double stack)	1.77
DMX-K-DRV-11-3 (triple stack)	2.01

Table 4.0

DMX-K-DRV-17

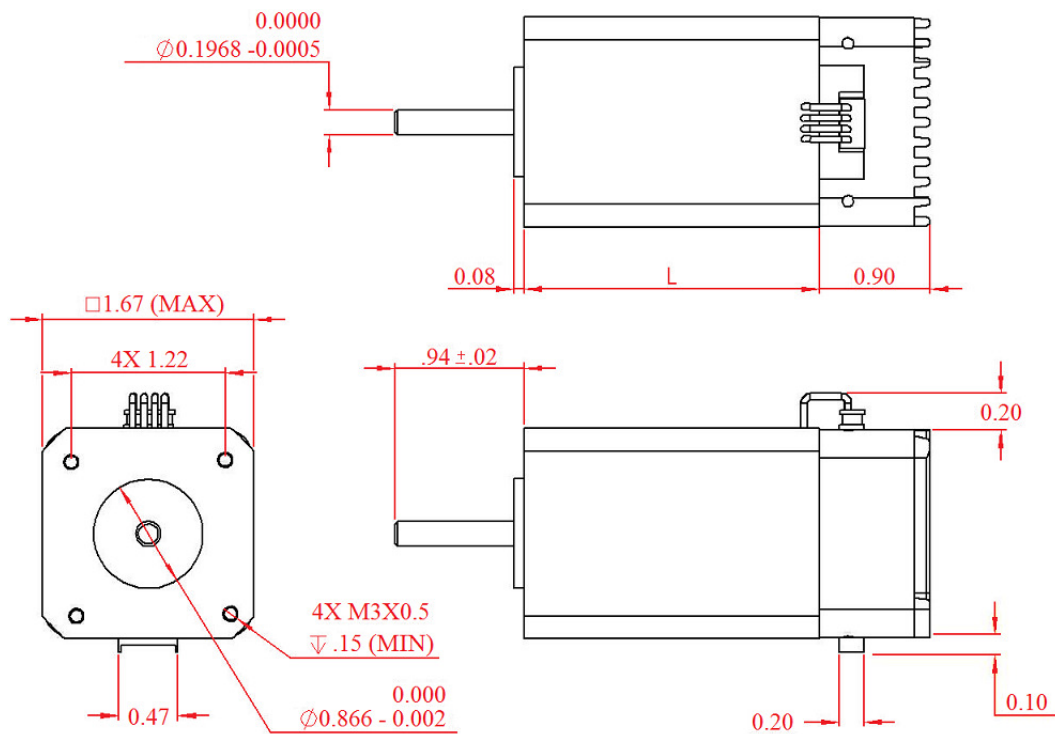


Table 4.1

NEMA 17 Models	L (inches)
DMX-K-DRV-17-2 (double stack)	1.58
DMX-K-DRV-17-3 (triple stack)	1.89

Table 4.1

DMX-K-DRV-23

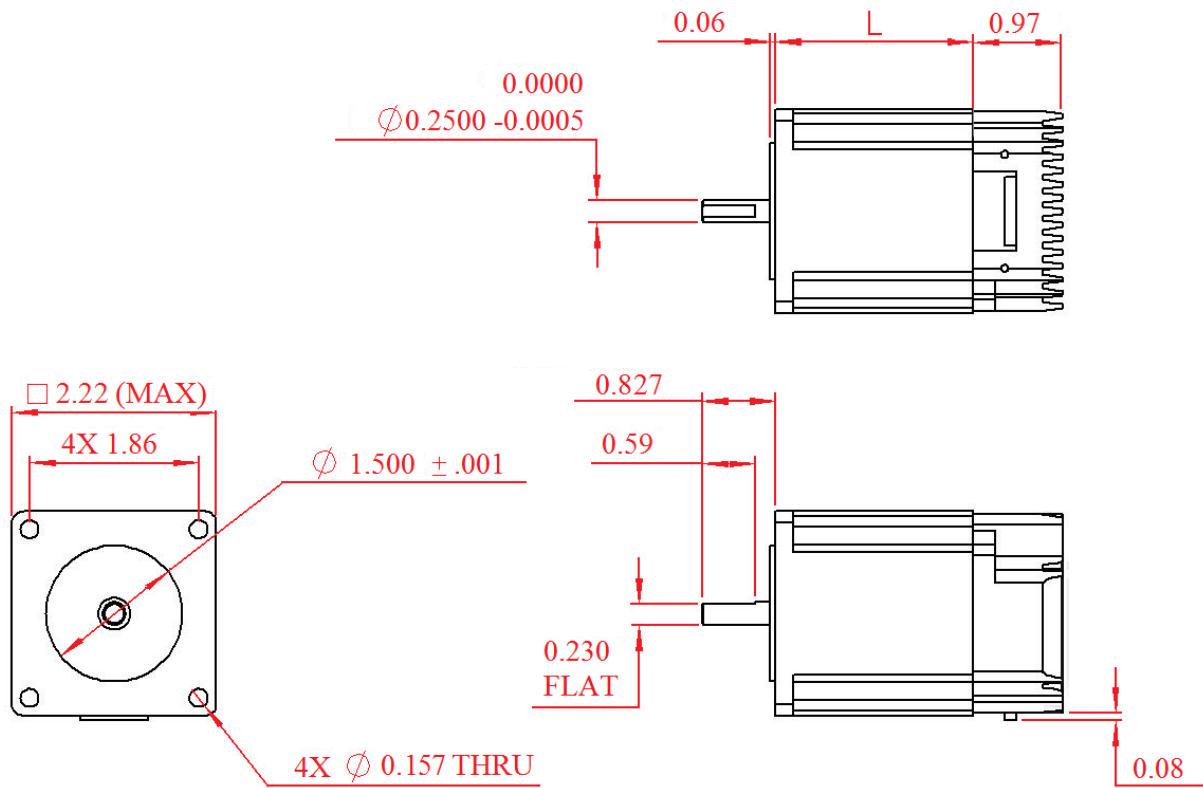


Figure 4.2

NEMA 23 Models	L (inches)
DMX-K-DRV-23-2 (double stack)	2.20
DMX-K-DRV-23-3 (triple stack)	2.99

Table 4.2

5. Motor Specifications

Following chart shows the specifications of standard step motors used for DMX-K-DRV products. All standard DMX-K-DRV step motors are 1.8 degree bi-polar step motors.

NEMA Size	Stack Size	Max Amp (RMS) / Phase	Holding Torque	Resistance / Phase	Inductance / Phase	Inertia
11	Double	1.3A	0.1 N-m	1.3 Ohm	0.8 mH	0.07 oz-in ²
	Triple	1.3A	0.12 N-m	1.9 Ohm	1.7 mH	0.1 oz-in ²
17	Double	1.7A	0.44 N-m	1.5 Ohm	3.0 mH	0.28 oz-in ²
	Triple	2.0A	0.59 N-m	1.4 Ohm	2.7 mH	0.37 oz-in ²
23	Double	2.8A†	0.95 N-m	0.9 Ohm	2.5 mH	1.64 oz-in ²
	Triple	2.8A†	1.41 N-m	1.13 Ohm	3.6 mH	2.62 oz-in ²

Table 5.0

† Even though NEMA 23 motors are rated for 2.8A (RMS), maximum current DMX-K-DRV supports is 2.5A (peak).

6. Torque Curves

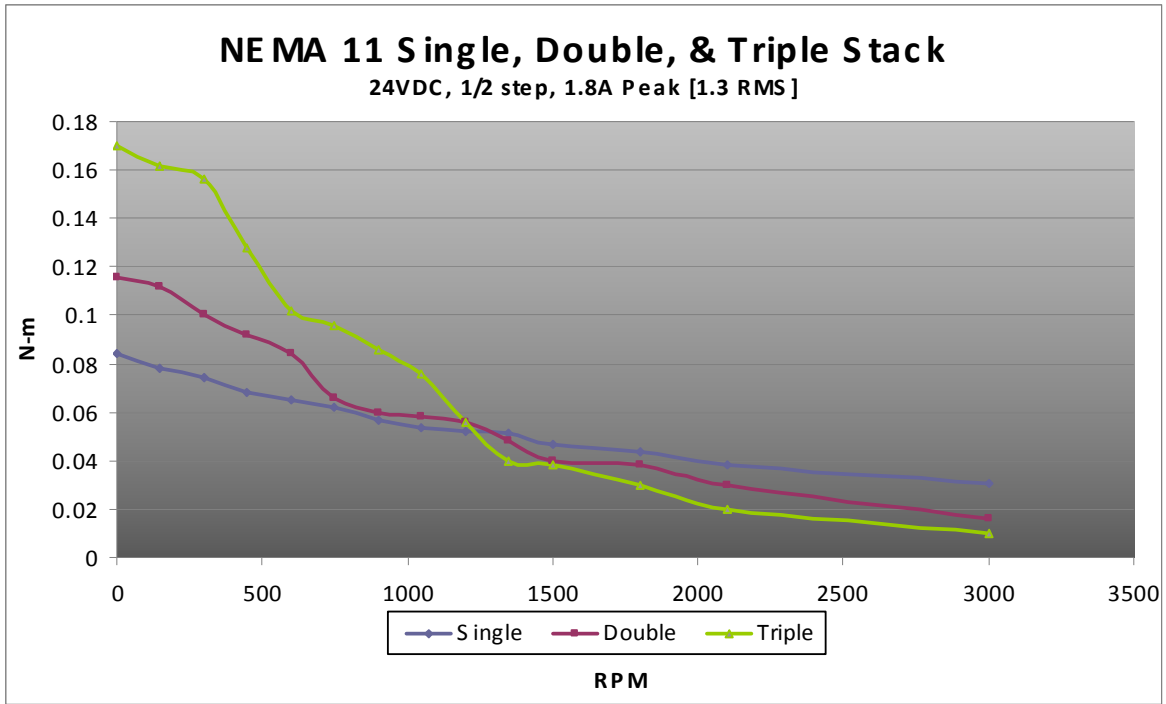


Figure 6.0

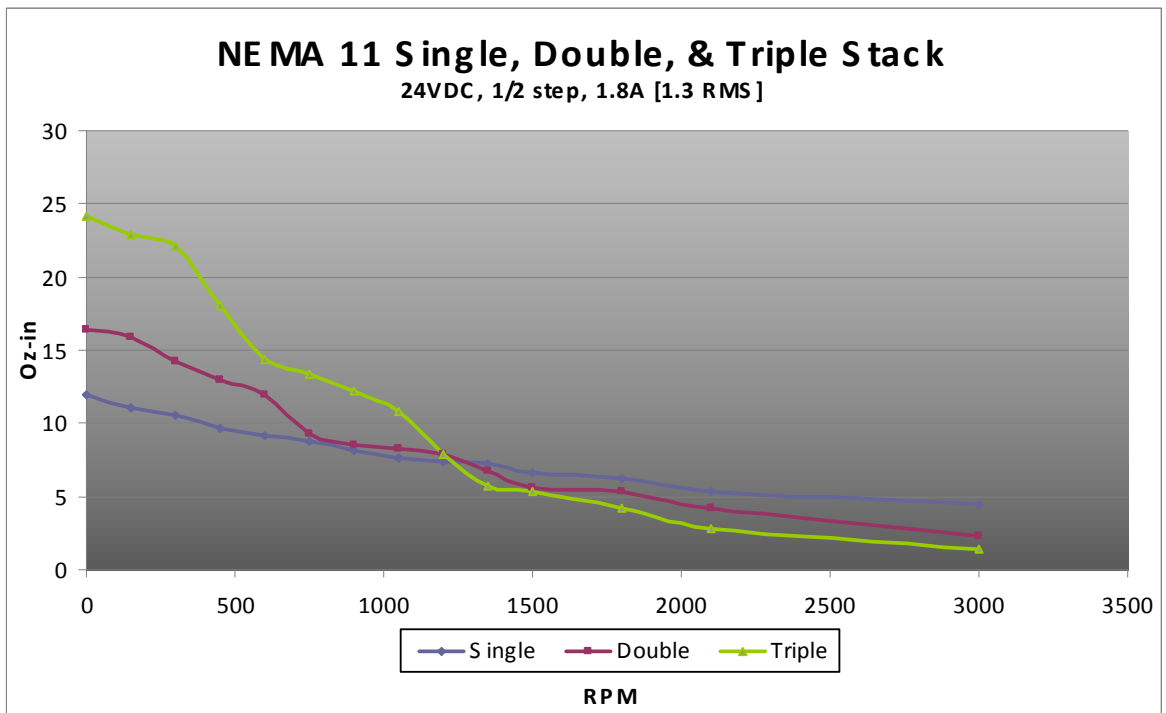


Figure 6.1

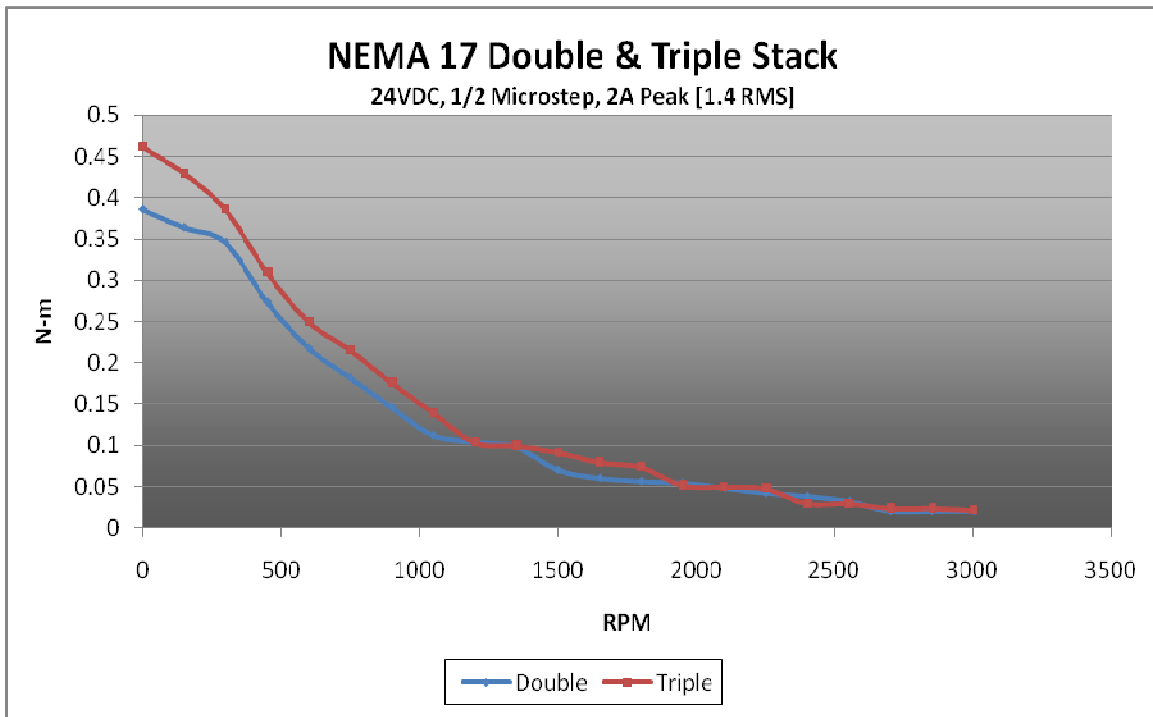


Figure 6.2

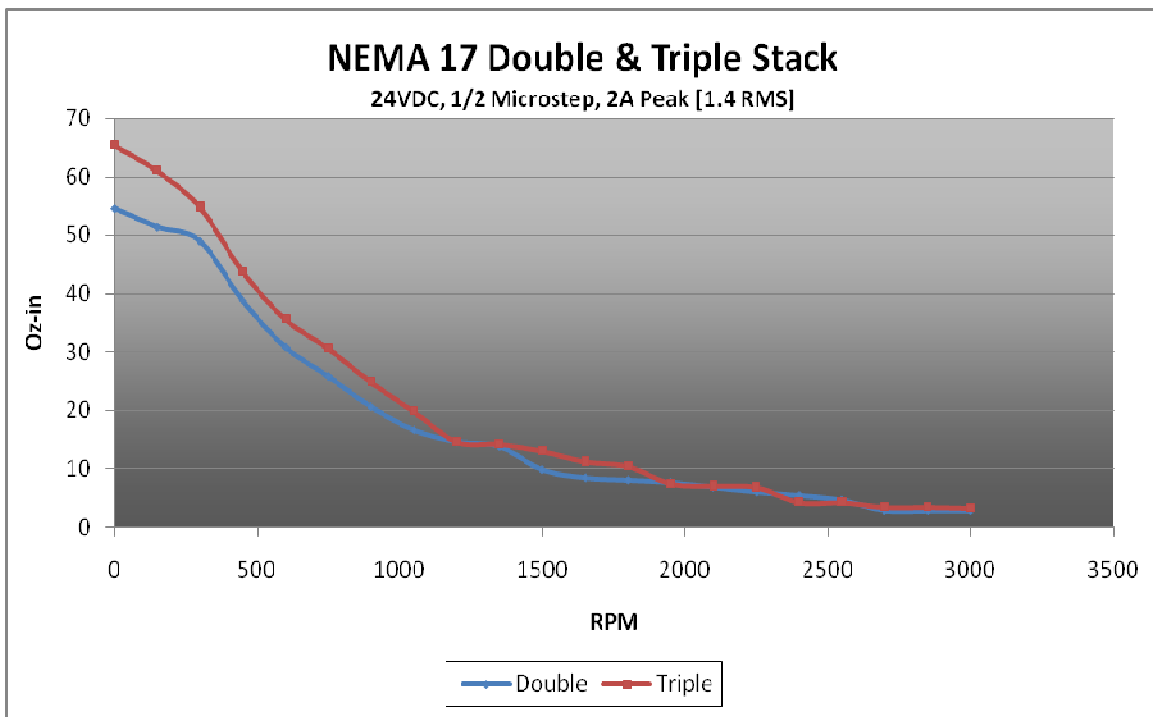


Figure 6.3

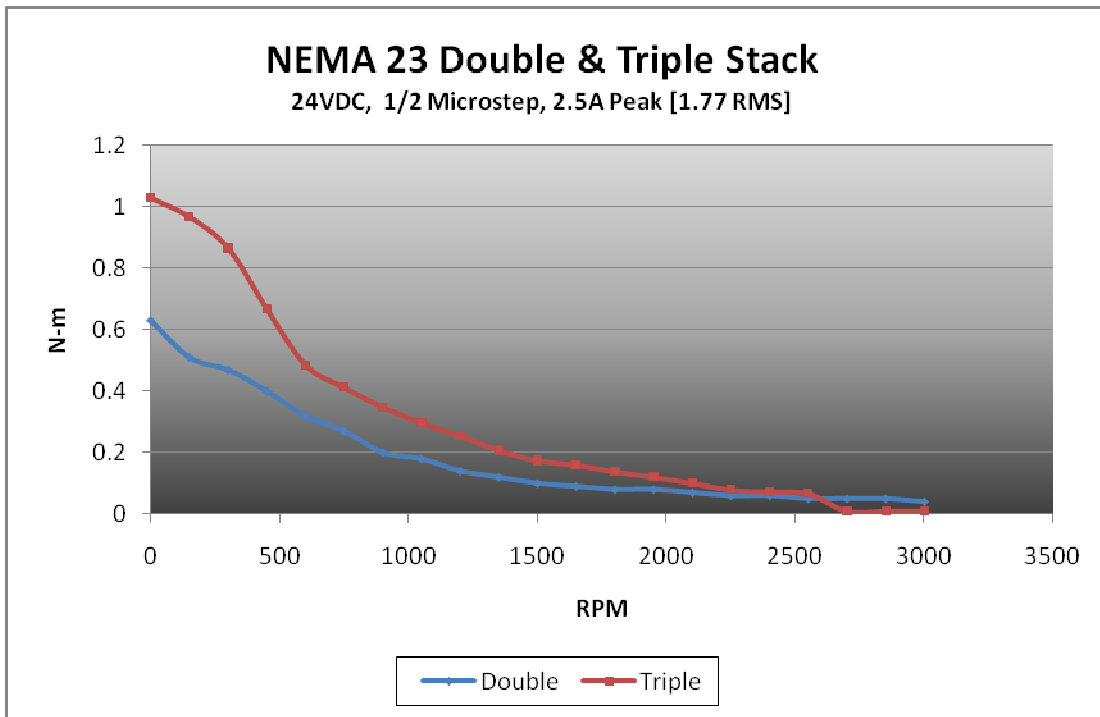


Figure 6.4

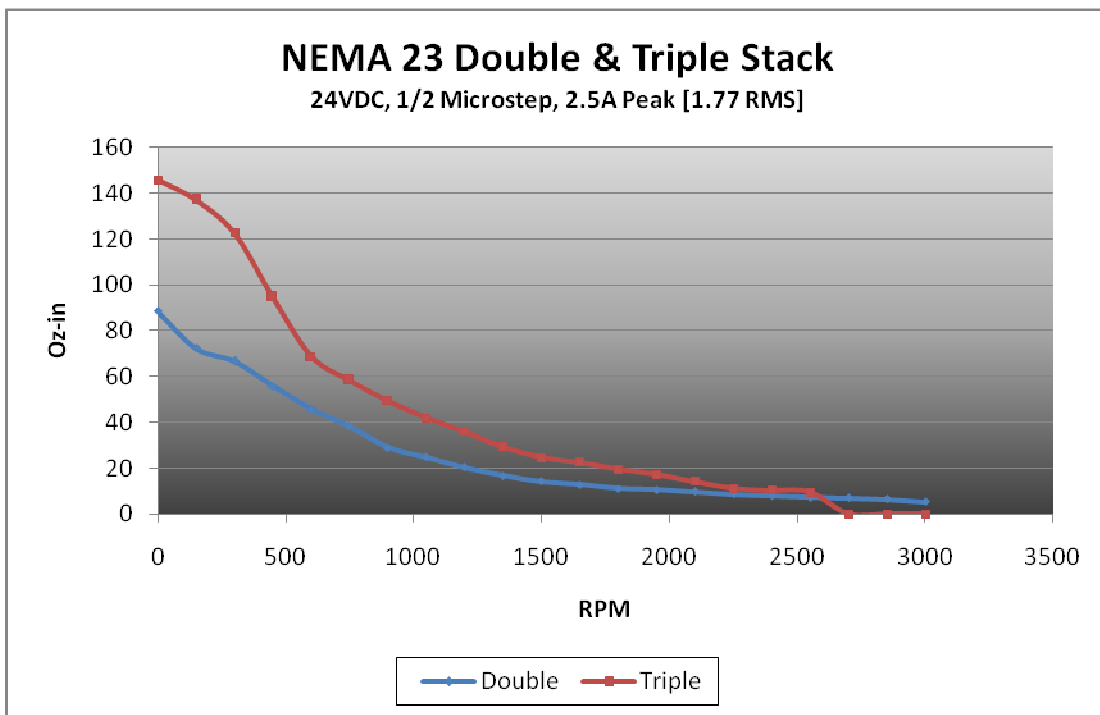


Figure 6.5

7. Connections

DMX-K-DRV-11/17 Pin-out

DMX-K-DRV-11 and 17 come with same 10 pin connector with the pin-out as shown below.

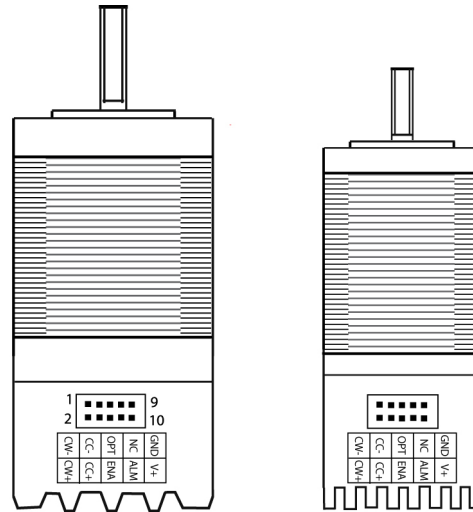


Figure 7.0

Pin #	In/Out	Name	Description
1	I	PUL- (CW-)	Negative pulse input / Negative clockwise input
2	I	PUL+ (CW+)	Positive pulse input / Positive clockwise input
3	I	DIR- (CCW-)	Negative direction input / Negative counter-clockwise input
4	I	DIR+ (CCW)	Positive direction input / Positive counter-clockwise input
5	I	OPTO	Opto-supply for enable input
6	I	ENABLE	Enable motor input
7	NC	NC	Reserved. Do not connected
8	ALARM	DO	Alarm output
9	I	GND	Power input ground
10	I	V+	Power

Table 7.0

DMX-K-DRV-11/17 Mating Connector

Description: Female 10 pin 2mm dual row
 Manufacturer: HIROSE
 Part Number: DF11-10DS-2C (10 pin female connector)
 DF11-2428SC (female socket pin)

Important Notes:

- Maximum current that can handle for the connector is 2 Amps (RMS).
- For the Power V+ and Ground lines, 24-gage wire with Teflon insulation is recommended. Check with wire manufacturer for the maximum current rating for the wire.

DMX-K-DRV-23 Pin-out

DMX-K-DRV-23 comes with single row 10 pin connector as shown below.

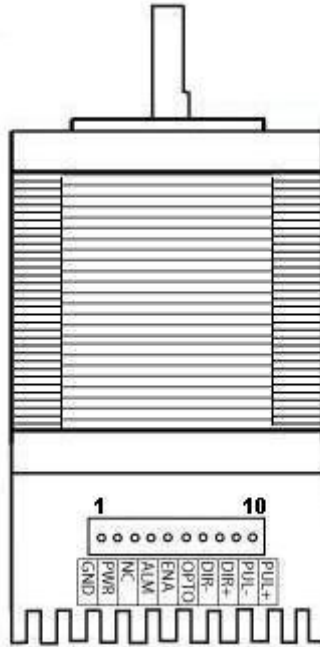


Figure 7.1

Pin #	In/Out	Name	Description
1	I	GND	Power input ground
2	I	V+	Power
3	NC	NC	Reserved. Do not connected
4	O	ALARM	Alarm output
5	I	ENABLE	Enable motor input
6	I	OPTO	Opto-supply for enable input
7	I	DIR- (CCW-)	Negative direction input / Negative counter-clockwise input
8	I	DIR+ (CCW)	Positive direction input / Positive counter-clockwise input
9	I	PUL- (CW-)	Negative pulse input / Negative clockwise input
10	I	PUL+ (CW+)	Positive pulse input / Positive clockwise input

Table 7.1

DMX-K-DRV-23 Mating Connector

Description: Female 10 pin 2mm single row
 Manufacturer: HIROSE
 Part Number: DF3-10S-2C (10 pin female connector)
 DF3-2428SC (female pin)

Important Notes:

- Maximum current that can handle for the connector is 3 Amps (RMS).
- For the Power V+ and Ground lines, 24-gage wire with Teflon insulation is recommended. Check with wire manufacturer for the maximum current rating for the wire.

Interface Circuit

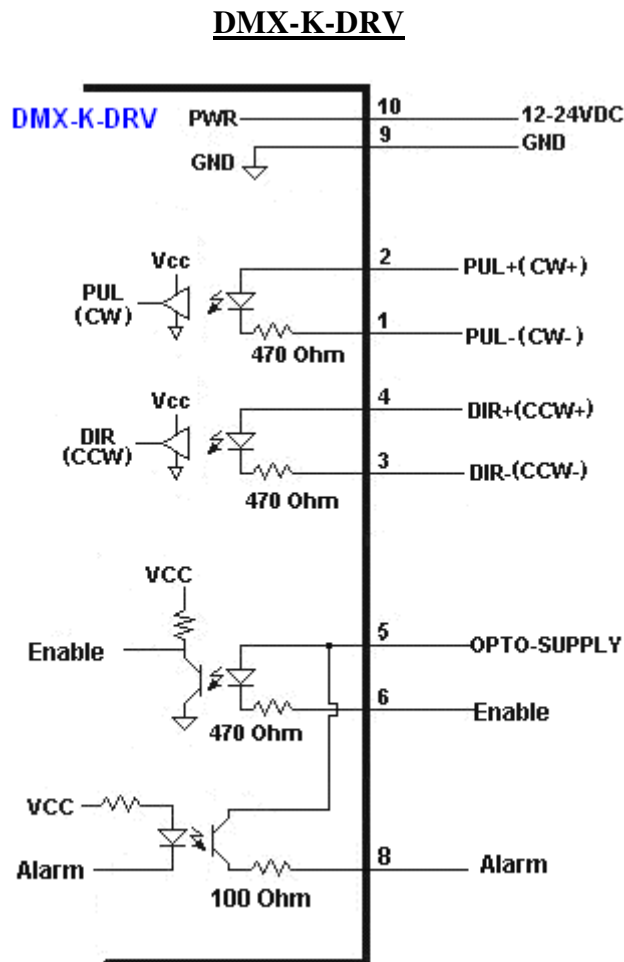


Figure 7.2

Pulse/Dir (CW/CCW) Inputs

DMX-K-DRV supports both one-clock (PULSE/DIR) and two-clock (CW/CCW) inputs. One-clock uses PUL signal as pulse train input position control and DIR signal as direction input signal for direction control.

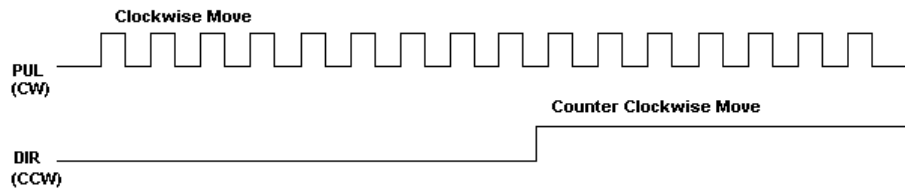


Figure 7.3

Two-clock uses CW as clockwise pulse input and CCW as counter clockwise pulse input for position control.

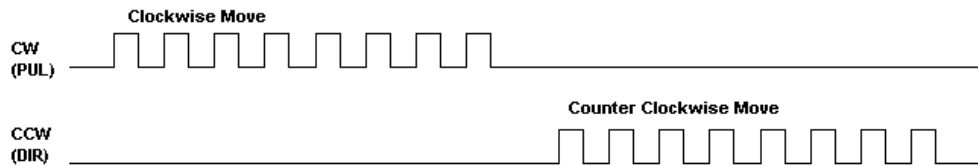


Figure 7.4

Depending on the direction polarity setting, actual direction of the rotation can be configured for the application.

Pulse/Dir (CW/CCW) inputs are opto-isolated differential inputs with 470 Ohm resistor:

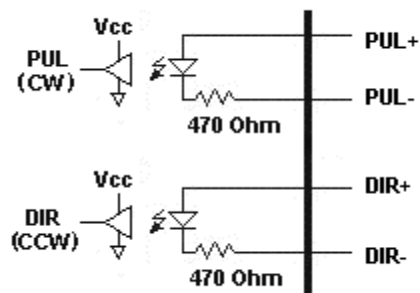


Figure 7.5

Example of Wiring using Differential Output

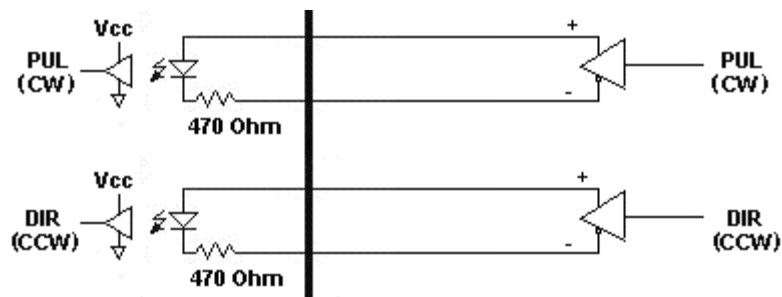


Figure 7.6

Example of Wiring using Open Collector Output

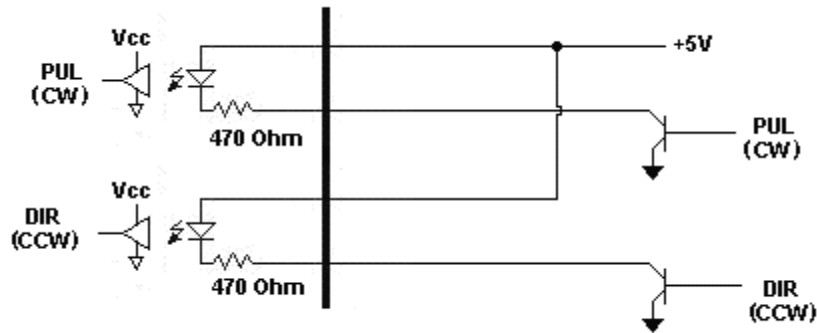


Figure 7.7

Important Note: The recommended voltage between the differential inputs is 5V. An additional current limiting resistor is required to support larger voltages.

Enable Input

Enable Input is an opto-isolated input with a 470 Ohm resistor and Diode.

Example Wiring of Enable Input

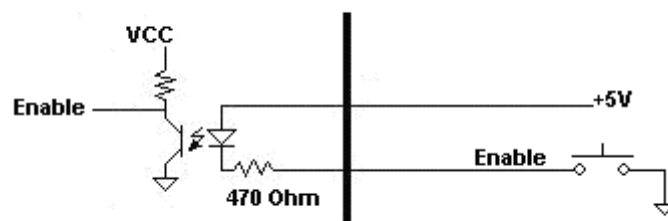


Figure 7.8

Important Note: The recommended voltage between the differential inputs is 5V. An additional current limiting resistor is required to support larger voltages.

Alarm Output

Alarm output is an opto-isolated output with 100 Ohm resistor.

Example Wiring of Alarm Output

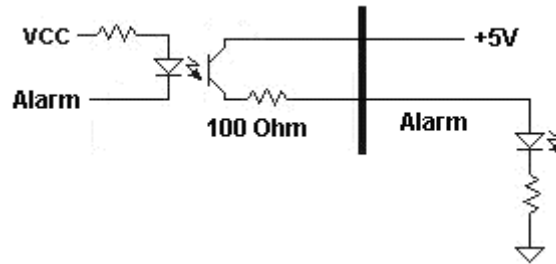


Figure 7.9

8. General Specifications

Microstep

The configurable microstep settings are: Full Step, Half Step, Quarter Step and 1/16 Step.

Current Control

DMX-K-DRV has a configurable current setting from 100mA to 2.5A peak current.

Driver current is set to Run Current when the pulse input is detected and remains in run current while the pulse input is detected.

Idle Current is used when the pulse input is idle for the duration set by the Idle Time.

Run Current and the Idle Current should not go over the maximum rated current for each motor size. Use the chart below as a reference on maximum rated current setting.

Product	Maximum Peak Rated Driver Current Setting (Amp)
DMX-K-DRV-11-2	1.2
DMX-K-DRV-11-3	1.2
DMX-K-DRV-17-2	1.7
DMX-K-DRV-17-3	2.0
DMX-K-DRV-23-2	2.5
DMX-K-DRV-23-3	2.5

Table 8.0

Over Temperature Alarm

DMX-K-DRV has a temperature sensor to detect over heating of the driver. Temperature sensing is done only when the driver is enabled. When the temperature goes over the over-temperature alarm value 70 C°, the Alarm Output is turned on. If the temperature goes below the 68 C°, the alarm output is turned off. If the temperature goes over 75 C°, the driver is automatically turned off and remained off until the temperature goes below 68 C°.

The automatic temperature shutdown feature can be enabled or disabled during the configuration process. Refer to Section 9 for further details.

For additional regarding temperature precautions, see Appendix A.

For details on wiring the alarm output, see Figure 7.9.

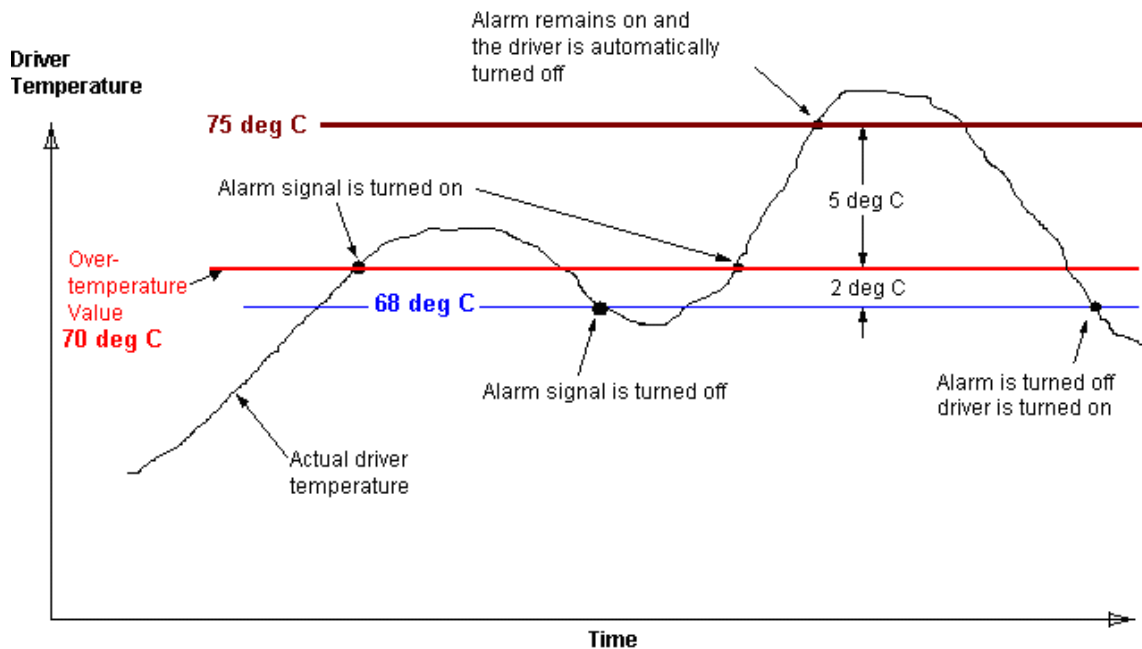


Figure 8.0

DIO Control

The DMX-K-DRV has built-in controller capability for NEMA 17/23 models. When configured in controller mode, the DIR, ENABLE, PUL and ALARM signals are used for DIO Control. See below for the signal descriptions.

In/Out	Name	Description
I	OPTO / ENABLE	Select 2 bit motion profile (Bit 0)
I	DIR- / DIR+	Select 2 bit motion profile (Bit 1)
I	PUL- / PUL+	Trigger motion profile or abort a current move operation
O	ALARM	In-position output †

Table 8.1

† If “Over Temp Shutdown” feature is enabled, the alarm output operates as a temperature alarm output and not an in-position output. To use as an in-position output, the “Over Temp Shutdown” feature must be disabled.

Important Notes:

- Controller mode is only available for NEMA 17/23 models.
- While in controller mode, the motor is always enabled.
- If the direction signal is toggled while the enable signal is off, the alarm signal will turn on because of its use in the Dynamic Configuration algorithm. Therefore, it is advised to toggle the enable signal before selecting a motion profile. This will prevent the alarm output from erroneously triggering.

Movement types and their corresponding parameters are shown in the table below.

Move Type	Description	Target Position	Speed (PPS)
JOG+/-	Move the motor continuously.	N/A	0-16000
ABS	Move the motor to the target position.	32 bit number	0-16000
INC	Increment the motor by the target position.	32 bit number	0-16000

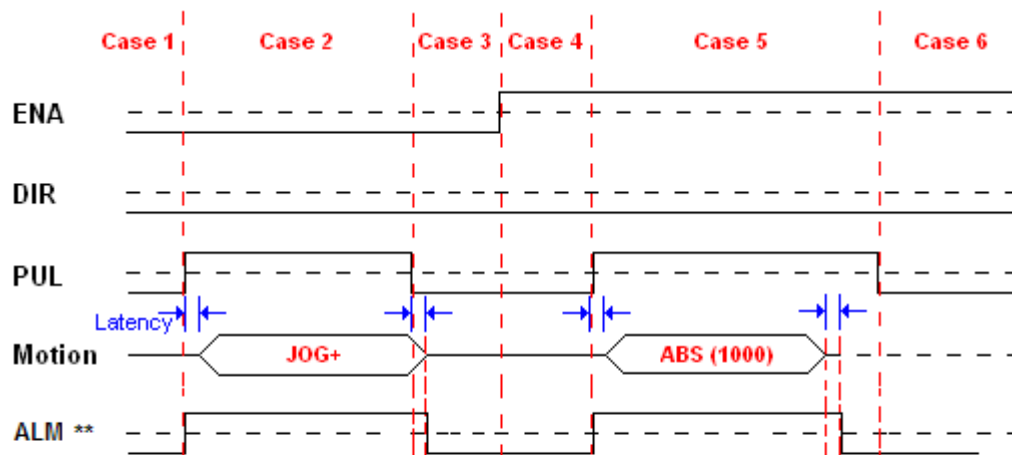
Table 8.2

Example Timing Diagram for DIO Control

Assuming that the parameters shown in Table 8.2 are stored in the DMX-K-DRV, Figure 8.1 and Table 8.3 provide example usage of DIO control.

Motion Profile		Move Type	Target Position	Speed (PPS)
ENA	DIR			
0	0	JOG+	0	10000
0	1	JOG-	0	10000
1	0	ABS	1000	5000
1	1	INC	-1000	5000

Table 8.3



* Latency = 500-550 us

** If Over Temp Shutdown is disabled, the alarm output is used as an "In Position" output. The signal will turn on while the motor is in motion, and turn off when the motor is idle.

Figure 8.1

Case	Motion Profile		PUL	Result
	ENA	DIR		
1	0	0	0	DMX-K-DRV is idle. Chose motion profile is JOG+.
2	0	0	1	DMX-K-DRV is jogging in the positive direction at a speed of 10000 pps. Motion starts on the rising edge of the PUL signal.
3	0	0	0	DMX-K-DRV has stopped all motion on the falling edge of the PUL signal.
4	1	0	0	DMX-K-DRV is idle. Chosen motion profile is ABS with a target position of 1000.
5	1	0	1	DMX-K-DRV is moving to pulse position 1000. Note that the motor will stop once the desired position is reached, regardless of the PUL signal.
6	1	0	0	DMX-K-DRV is idle.

Table 8.4

9. Driver Configuration

Following are DMX-K-DRV parameters that can be configured:

- 1) Microstep Setting: Full, Half (1/2), Quarter (1/4), Sixteen(1/16)
- 2) Run Current: 100mA to 2.5A peak current
- 3) Idle Current: 100mA to 2.5A peak current
- 4) Idle Time: 100 msec to 10 sec
- 5) Direction Polarity
- 6) One-clock or Two-clock mode
- 7) Controller or Driver mode: (NEMA 17/23 only)
 - A. Driver mode requires pulse and direction signals to move the motor.
 - B. Controller mode uses the Enable and Direction inputs to specify a set of motion parameters and the Pulse input to start and stop motion.
- 8) Over Temperature Shutdown: Determines whether or not the DMX-K-DRV disables when the temperature rises above a specified threshold. See Figure 8.0 for details.
- 9) DIO motion parameters: Up to four motion profiles can be set and used when the DMX-K-DRV is in controller mode. (NEMA 17/23 only)

DMX-K-DRV uses patented Dynamic Configuration Method to read and write the driver parameters using the control signals (Pulse, Dir, Enable, and Alarm) of the driver. Dynamic Configuration eliminates the need for jumpers, switches, resistors, potentiometers and communication port for reading and setting the driver parameters. This results in a simple and cost-effective device.

Default Settings – Driver Mode

Product	μ Step	Run Current (A)	Idle Current (A)	Idle Time (ms)	Dir	Clock	Mode	Over Temp Shutdown
DMX-K-DRV-11-2	16	1.0	0.5	500	CW	One	Driver	ON
DMX-K-DRV-11-3	16	1.0	0.5	500	CW	One	Driver	ON
DMX-K-DRV-17-2	16	1.6	0.5	500	CW	One	Driver	ON
DMX-K-DRV-17-3	16	1.6	0.5	500	CW	One	Driver	ON
DMX-K-DRV-23-2	16	2.2	1	500	CW	One	Driver	ON
DMX-K-DRV-23-3	16	2.2	1	500	CW	One	Driver	ON

Table 9.0

Important Note: When setting the run and idle current, make sure to keep the current value below the maximum allowed current that each motor can handle. Note the following maximum current that each product can handle. See Table 8.0 for motor current specifications.

Default Settings – Control Mode

Motion Profile		Move Type	Target Position	Speed
ENA	DIR			
0	0	ABS	10000	10000
0	1	ABS	10000	10000
1	0	ABS	10000	10000
1	1	ABS	10000	10000

Table 9.1

Configuration Cables

The DMX-CFG-USB-K117 and DMX-CFG-USB-K23 cables are used to configure the DMX-K-DRV. The following cables can configure the corresponding models.

- DMX-CFG-USB-K117 → DMX-K-DRV-11/17
- DMX-CFG-USB-K23 → DMX-K-DRV-23

For additional configuration options, see Appendix B.

Connections

See Figures 9.0 and 9.1 to see how the configuration cables are connected to the DMX-K-DRV.

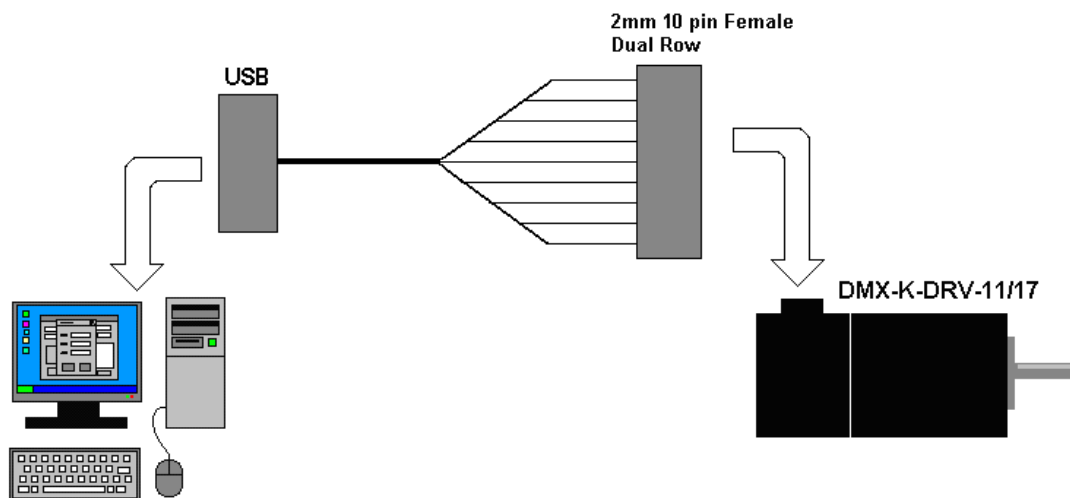


Figure 9.0

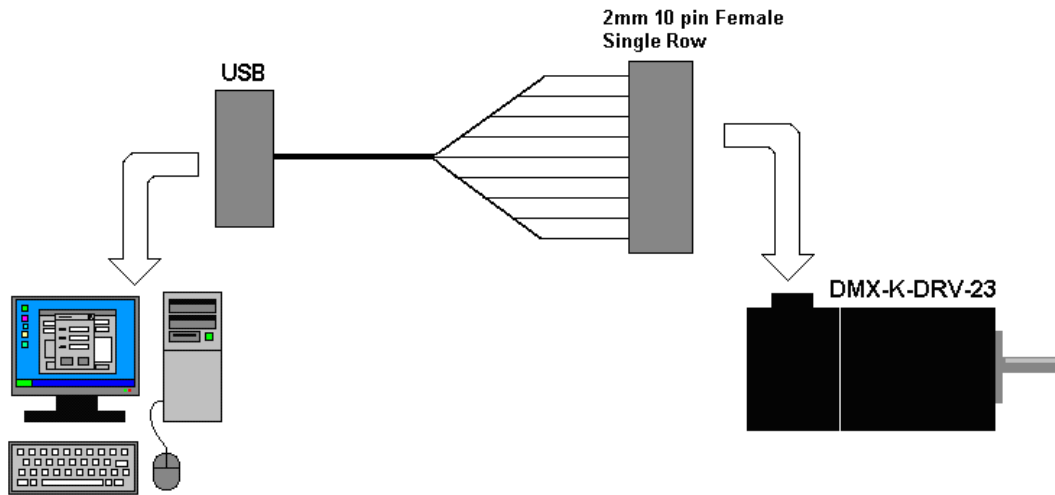


Figure 9.1

Software

Make sure that the USB driver is installed properly before running the controller. Note that newer versions of the DMX-CFG-USB-K117/23 cables use HID protocol, which do not require USB driver installation.

See the DMX-CFG-USB Cables manual for details on configuration. Figure 9.2 shows the configuration interface.

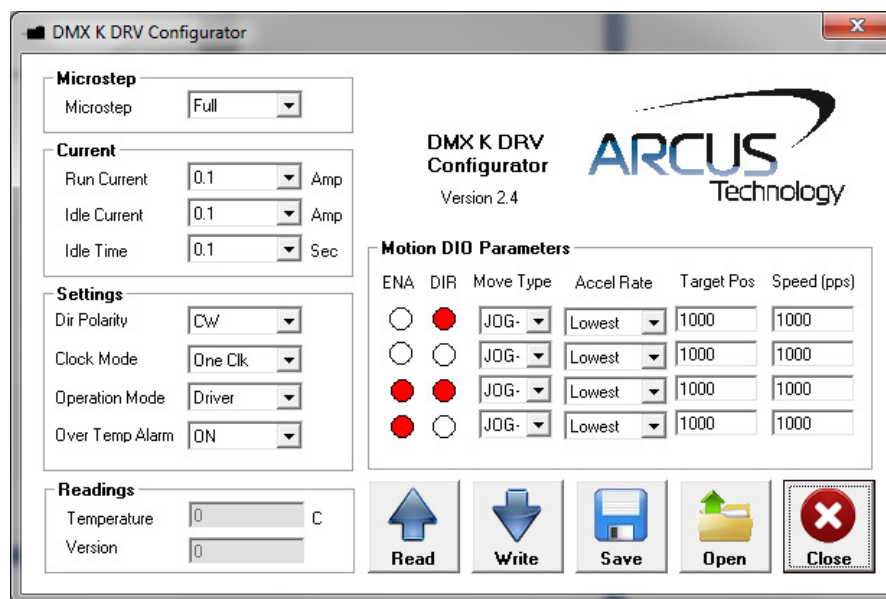


Figure 9.2

Appendix A: Heat dissipation

Electronic components used in the DMX-K-DRV have a maximum ambient operating temperature of **85 C°**. DMX-K-DRV electronics are potted with heat-conductive compound to the housing to evenly distribute the heat and reduce any hot spots in the driver. The housing also has integrated fins to better dissipate the heat.

DMX-K-DRV should be mounted securely to a metallic bracket that can also act as a heat-sink. During operation, the step motor section typically becomes hotter than the driver section. Having the step motor mounted to a heat sink will help dissipate the heat generated by the step motor.

DMX-K-DRV mounting orientation should be such that the fins are oriented vertically for better convection and heat dissipation. See Figure A.0 below.

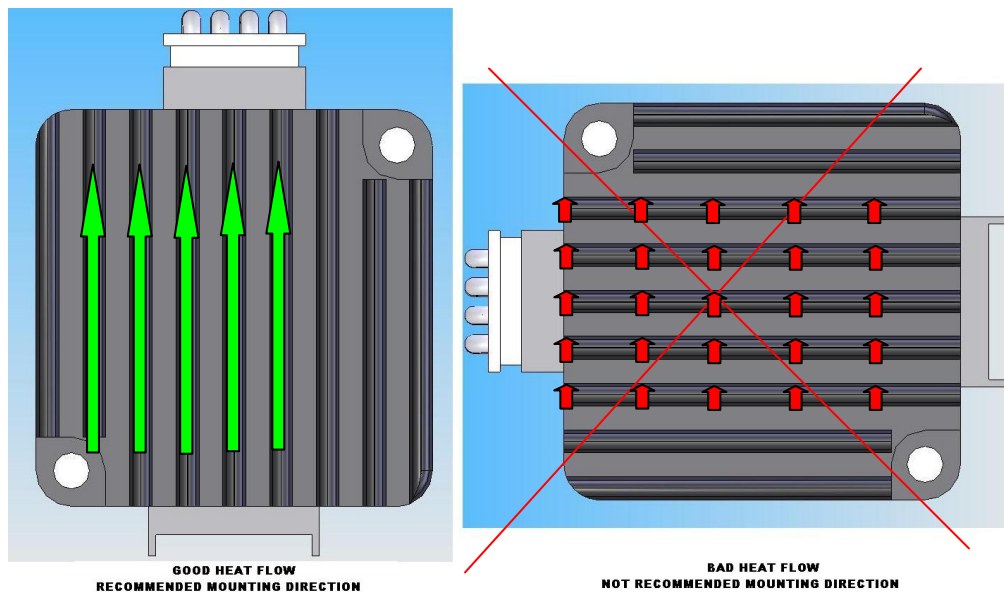


Figure A.0

Appendix B: Other Configuration Methods

DMX-K-DRV can be configured using either an ACE-SXC single axis controller or a DMX-CFG-USB-V2 and with or without a Windows PC.

The advantage of using either of these modules instead of the dedicated configuration cables is that configuration can be achieved without a PC.

See Figure B.0 for the two configuration methods.

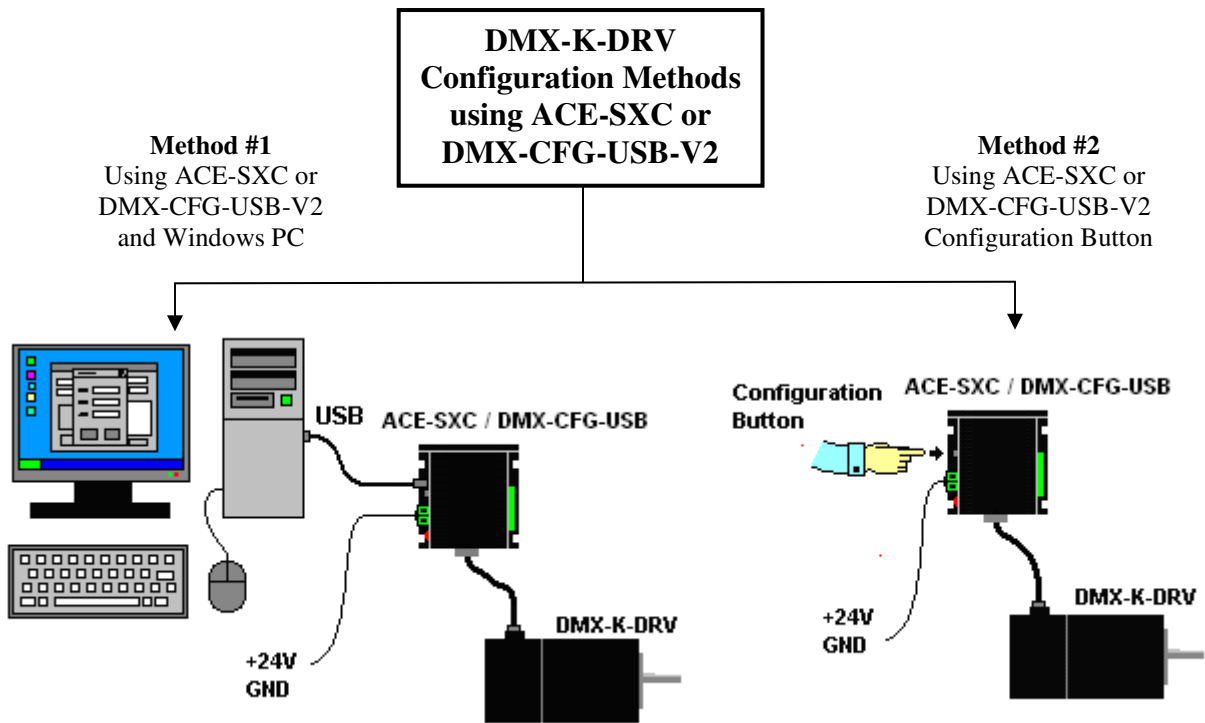


Figure B.0

Wiring

See wiring diagrams in Figures B.1 and B.2 to connect the ACE-SXC / DMX-CFG-USB-V2 to the DMX-K-DRV. Cables accessories are available for purchase.

Cable Accessory: CBL-DB 9M-DF11 10F-L1-G22-V1

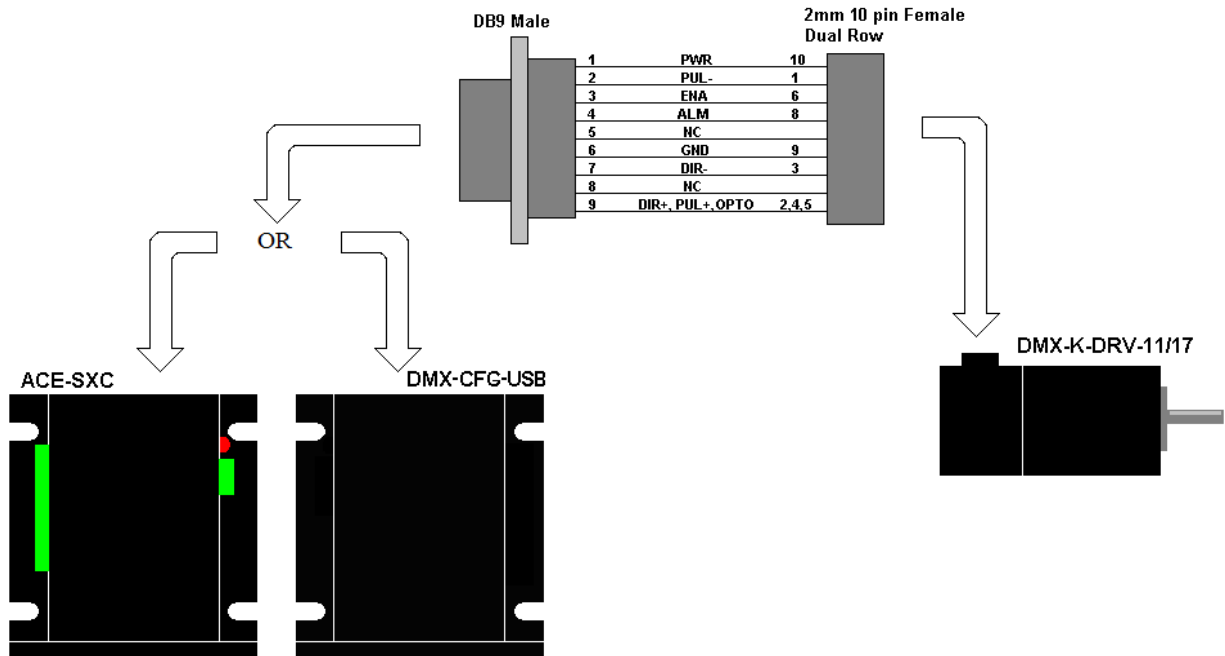


Figure B.1

Cable Accessory: CBL-DB 9M-DF3 10-L1-G22-V1

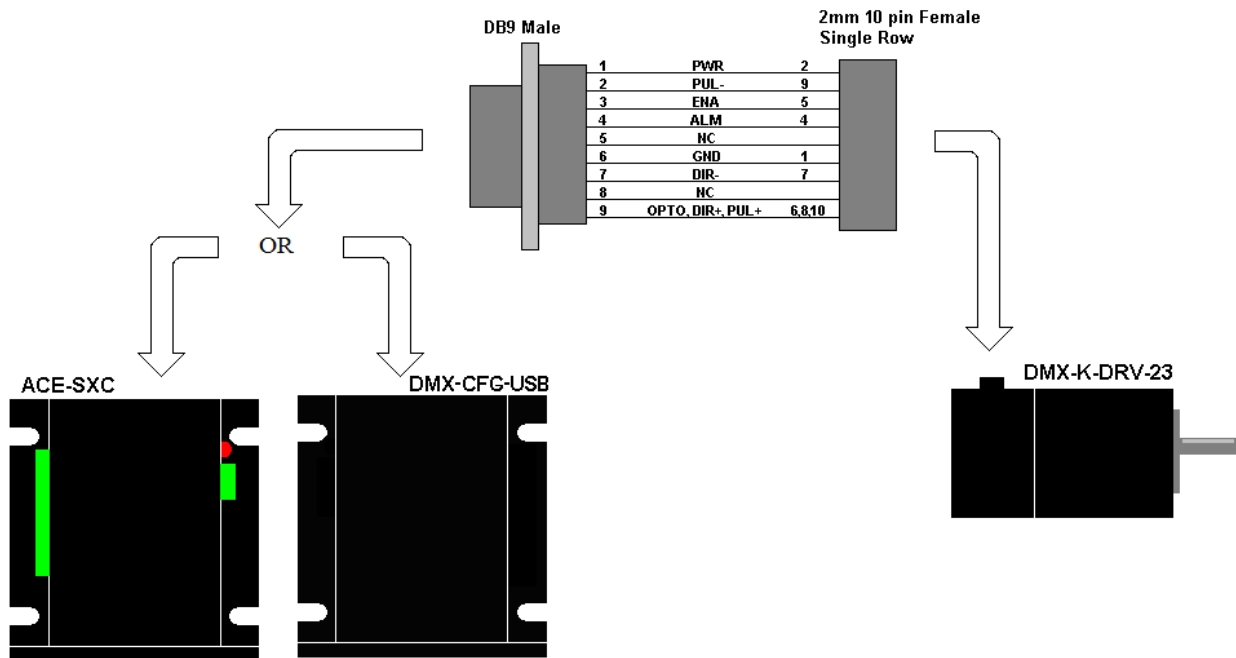


Figure B.2

Software: ACE-SXC

Before connecting to the ACE-SXC, be sure that the correct USB driver is installed. For details on configuration, see the ACE-SXC manual. Figure B.3 shows the configuration interface.

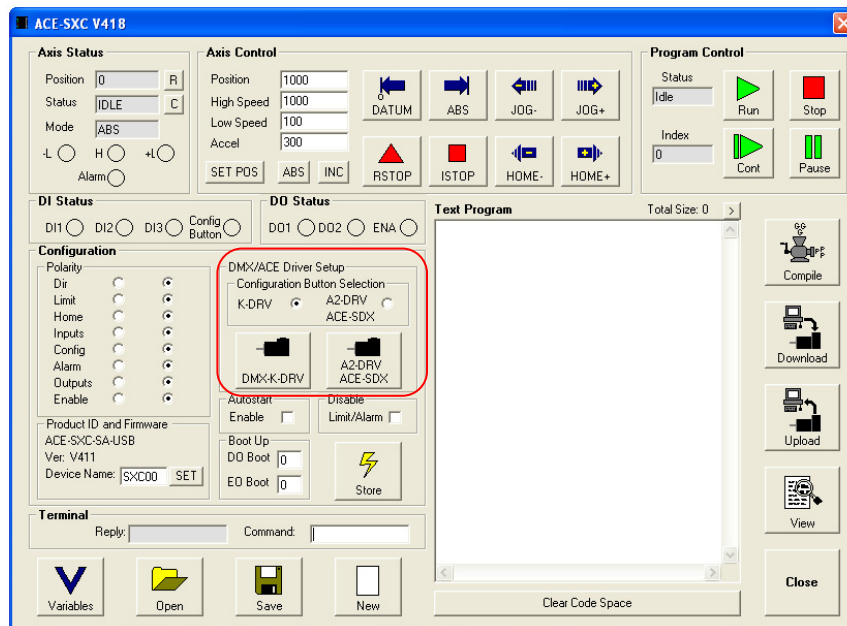


Figure B.3

Software: DMX-CFG-USB-V2

Before connecting to the DMX-CFG-USB-V2, be sure that the correct USB driver is installed. For details on configuration, see the DMX-CFG-USB-V2 manual. Figure B.4 shows the configuration interface.

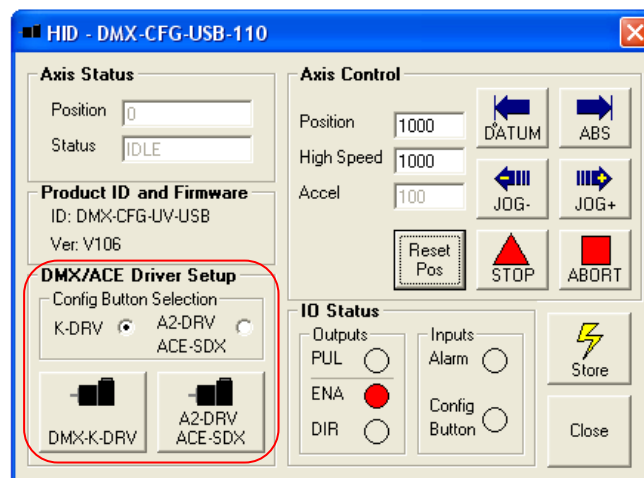


Figure B.4

Contact Information

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