

# MBC25161-120V Bipolar Microstep Driver

## User's Guide



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## MBC25161-120V Features

- 2.5 Amps/Phase Output Current
- Bipolar Microstepping Driver Operation
- Over Temperature and Short Circuit Shutdown
- Microstep Divisors of 16, 4, 2, or Full Step
- 85 - 135 VAC Power Input Power Requirement
- Accepts TTL Logic or 24V Level Inputs
- Ideal for Precise Positioning
- Efficient and Durable
- Long Life Expectancy

## General Description

The MBC25161-120V is a compact, low profile package meant to be used where space is limited but performance is expected and eliminates the need for an external power supply. The MBC25161-120V driver is a 2.5 amps/phase bipolar microstep driver capable of running four, six, and eight lead step motors from a supply of 120VAC. The driver has a motor bus voltage of 24V, capable of operating step motors with a power output of 50W. The MBC25161-120V has an output current range of 0.5 to 2.5 amps/phase and operates. The inputs are optically isolated with a minimum sourcing of 7.0mA per input (+3.5VDC minimum to +24VDC maximum). The clock input is set to receive either positive or negative edge clocks with a maximum frequency of 500kHz. The MBC25161-120V features include built in over temperature and short circuit shut down, automatic 70% reduction in current after clock pulses stop being received, and status LED's to indicate power on (green LED) and clocks being received (yellow LED).

With the MBC25161-120V, various step resolutions can be implemented by the MS1 and MS2 inputs. These divisions range from 200 steps per revolution to 3200 steps per revolution.

**CAUTION:** The MBC25161-120V driver does not have an internal fuse. To protect the driver from major motor failures, an external fuse greater than the application maximum load current is needed.

## Pin Descriptions

### TB2: 4 Pin - Motor Connection Terminal Description

Pin #	Description
1	<b>Phase A:</b> Phase 1 of the step motor
2	<b>Phase <math>\bar{A}</math>:</b> Phase 3 of the step motor
3	<b>Phase B:</b> Phase 2 of the step motor
4	<b>Phase <math>\bar{B}</math>:</b> Phase 4 of the step motor

Table 1: TB2 Terminal Descriptions

## TB1: 10 Pin - Input Signals Terminal Description

Pin #	Description
1	<b>Direction Anode (+):</b> This isolated input is used to change the direction of the motor. Physical direction also depends on the connection of the motor windings.
2	<b>Direction Cathode (-)</b>
3	<b>Step Clock Input Anode (+):</b> A positive going edge on this isolated input advances the motor one increment. The size of the increment is dependent on the Microstep Select Inputs of MS1 and MS2.
4	<b>Step Clock Input Cathode (-)</b>
5	<b>ON/OFF Anode (+):</b> This isolated input is used to enable and disable the output section of the driver. When HIGH (open) the outputs are enabled. However, this input does not inhibit the step clock.
6	<b>ON/OFF Cathode (-)</b>
7	<b>MS2 Input Anode (+):</b> This isolated input is used to select the microstepping format, as shown in table 7. Any changes made to these inputs do not take effect until the next rising edge of a step command signal on the Step Clock Input.
8	<b>MS2 Input Cathode (-)</b>
9	<b>MS1 Input Anode (+):</b> This isolated input is used to select the microstepping format, as shown in table 7. Any changes made to these inputs do not take effect until the next rising edge of a step command signal on the Step Clock Input.
10	<b>MS1 Input Cathode (-)</b>

Table 2: TB1 Terminal Descriptions

## TB3: 3 Pin - Input Power Terminal Description

Pin #	Description
1	AC IN: Hot
2	AC IN: Neutral
3	Earth Ground

Table 3: TB3 Terminal Descriptions

## Optically Isolated Inputs

The following inputs to the MBC25161-120V are Optically Isolated.

Item	Pin #
Direction	1 & 2
Clock	3 & 4
On/Off	5 & 6
MS2	7 & 8
MS1	9 & 10

Table 4: Inputs that are Optically Isolated

To enable an input, apply a DC voltage source of +5VDC to +24VDC across the inputs. The Anodes (+) are pins 1, 3 and 5 and the Cathodes (-) are pins 2, 4 and 6.

## Absolute Maximum Ratings

Input Voltage: 130VAC  
 Max Plate Temperature: 70°C  
 Storage Temperature: 0° to +50°C  
 Input Voltage (For isolated inputs): +3.5V to +24V  
 Hi-Pot Rating (10 seconds): Line to Ground  
 1000VAC

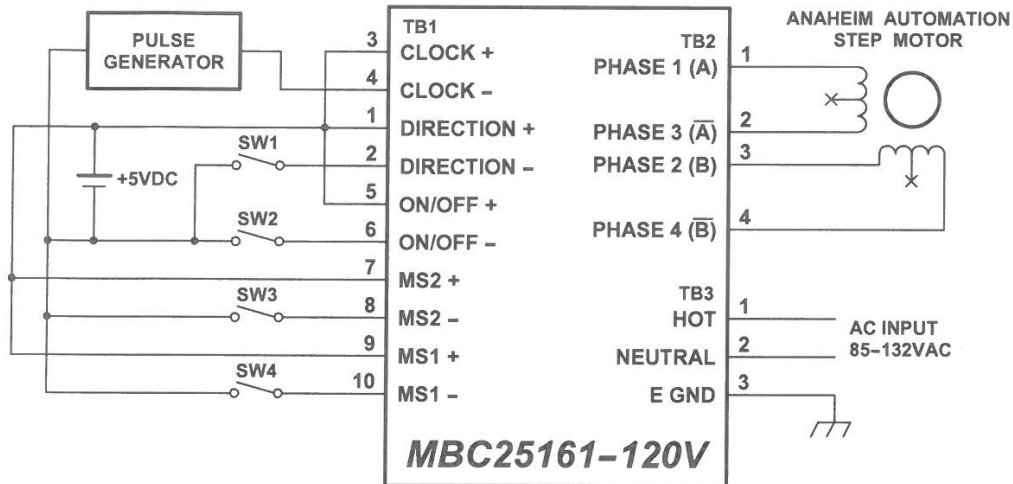
## Electrical Specifications

Item	Min	Typ	Max	Units
Input Operating Voltage	100	115	130	VAC
Motor Bus Voltage	23.5	24	24.5	VDC
Phase Output Current	0.35		1.77	A (RMS)
Phase Output Current	0.5		2.5	A (Peak)
Input Signal Voltage	3.5		24	V
Clock Frequency	0		500	kHz
Input Signal Voltage	3.5		24	V
Operating Temperature	0		70	C
Storage Temperature	0		50	C

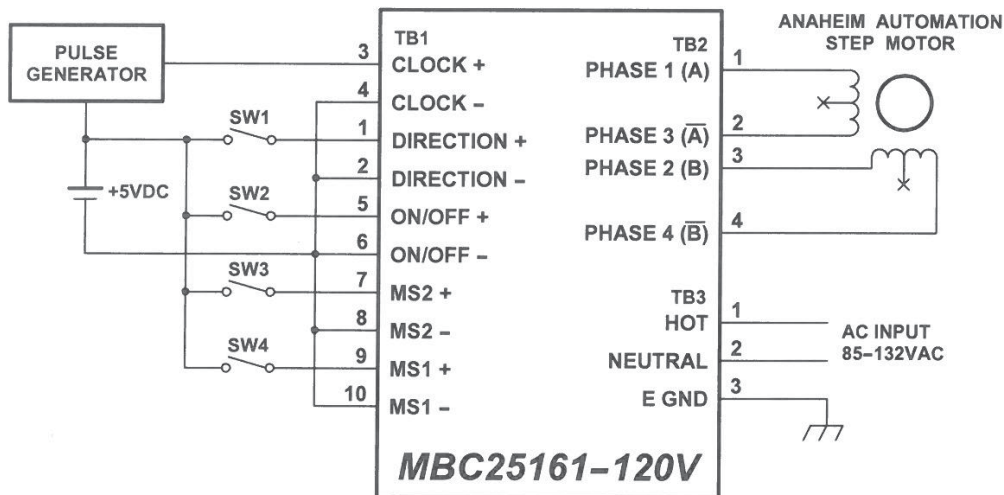
Table 5: Specifications

## Wiring Diagrams

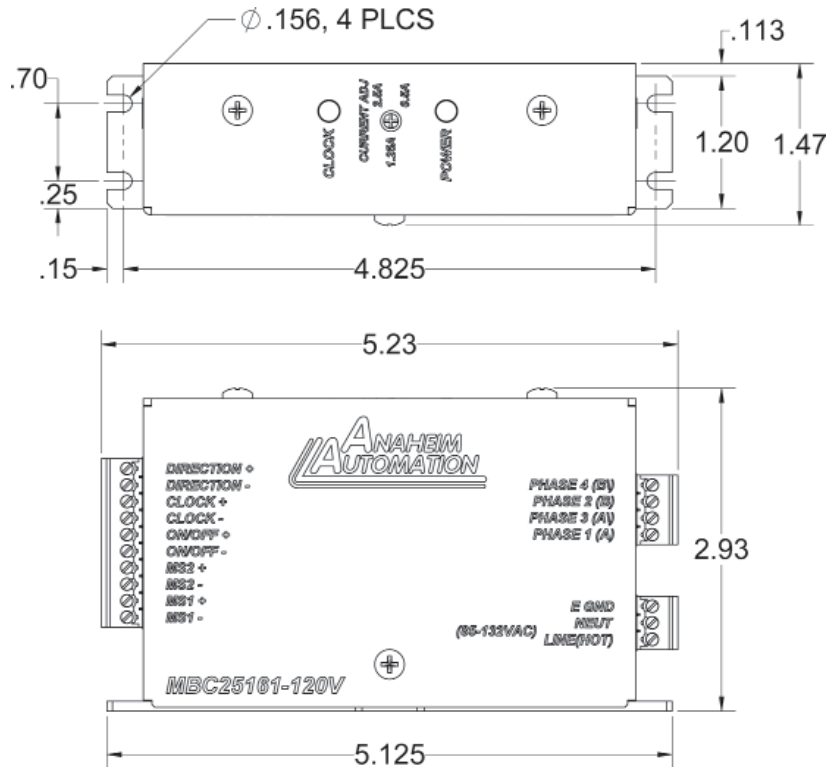
Sinking:



Sourcing:



## Dimensions



### Motor Selection

The MBC25161-120V is a Bipolar Microstep Driver that is compatible with both Bipolar and Unipolar Motor Configurations, (i.e. 8 and 4 lead motors, and 6 lead center tapped motors).

The MBC25161-120V driver is compatible with the following motor series: 08Y, 11Y, 14Y, 15Y, 17Y, and 23Y.

*Step motors with low current ratings and high inductance will perform better at low speeds, providing higher low-end torque. Motors with high current ratings and low inductance will perform better at higher speeds, providing more high-end torque.*

Since the MBC25161-120V uses a constant current source drive technique, it is not necessary to use a motor that is rated at the same voltage as the supply voltage. What is important is that the potentiometer is set to the appropriate current level based on the motor being used. Higher voltages will cause the current to flow faster through the motor coils. This in turn means higher step rates can be achieved. *Care should be taken not exceed the maximum voltage of the driver.*

**Anaheim Automation offers a comprehensive line of step motors in 8, 11, 14, 15, 17 and 23 frame sizes. Contact the factory to verify motor/drive compatibility.**

**Anaheim Automation offers motor cable, making hook-ups quickly and easy!  
Contact the factory or visit our website for more motor and cable offerings**

## Setting the Output Current

The output current on the MBC25161-120V is set by an onboard potentiometer. This potentiometer determines the per phase peak output current of the driver. The relationship between the output current and the potentiometer value is as follows:

Peak Current	Potentiometer Setting	Peak Current	Potentiometer Setting
0.5A	0%	1.7A	60%
0.7A	10%	1.9A	70%
0.9A	20%	2.1A	80%
1.1A	30%	2.3A	90%
1.3A	40%	2.5A	100%
1.5A	50%	--	--

Table 6: Output Current POT Settings

\*\* Although the MBC25161-120V is rated at 2.5A, current settings above 2.0Amps (75%) may require additional cooling.

**WARNING!** Step motors will run hot even when configured correctly. Damage may occur to the motor if a higher than specified current is used. Most specified motor currents are maximum values. Care should be taken to not exceed these ratings.

## Microstep Selection (MS1 and MS2 Settings)

MS1 and MS2 select the number of microsteps per step. The table below shows the standard resolution values along with the associated positions for the select switches. The standard waveforms are sinusoidal.

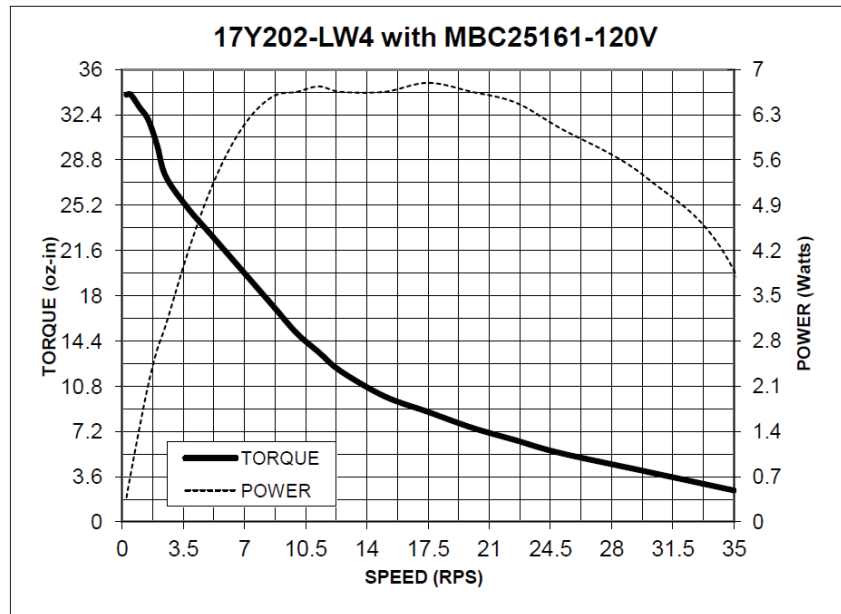
Microstep Resolution Truth Table		
MS1	MS2	Resolution
Active	Active	Full Step
Inactive (Open)	Active	Half Step
Active	Inactive (Open)	Quarter Step
Inactive (Open)	Inactive (Open)	Sixteenth Step

Table 7: MS1 and MS2 Settings

## Heating Considerations

The temperature of the heat sink should never be allowed to rise above 70° Celsius. If necessary, mount the unit to an additional heat sink or air should be blown across the heat sink to maintain suitable temperatures.

## Torque Curve



## Reducing Output Current

Reducing the output current is accomplished automatically and occurs approximately 20mSec after the last positive edge of the clock input has been received and current is sourced through the opto diode. The amount of current per phase in the reduction mode is approximately 70% of the set current. When the current reduction circuit is activated, the current reduction resistor is paralleled with the current adjustment potentiometer. This lowers the total resistance value, and thus lowers the per phase output current.

## Determine Output Current

The output current for the motor used when microstepping is determined differently from that of a full/half step unipolar driver. In the MBC25161-120V, a sine/cosine output function is used in rotating the motor. The output current for a given motor is determined by the motors current rating and the wiring configuration of the motor. There is a current adjustment potentiometer used to set the output current of the MBC25161-120V. This sets the peak output current of the sine/cosine waves. The specified motor current (which is the unipolar value) is multiplied by a factor of 1.0, 1.4, or 2.0 depending on the motor configuration (series, half-coil, or parallel).

## Step Motor Configurations

Step motors can be configured as 4, 6, or 8 leads. Each configuration requires different currents. Refer to the lead configurations and the procedures detail above to determine their output current.

**WARNING!** Step motors will run hot even when configured correctly. Damage may occur to the motor if a higher than specified current is used. Most specified motor currents are maximum values. Care should be taken to not exceed these ratings.

## Short-Circuit, Mis-Wire, and Over-Current Conditions

If it is found that there is a condition that causes an over current in the driver phase transistors, the Red LED will turn on solid and power will be shut off to the motor. To reset the drive turn power off, check wiring, and turn power back on.

## 4 Lead Motors

Multiply the specified **series** motor current by 1.4 to determine the current adjustment potentiometer value. Four Lead Motors are usually rated with their appropriate series current, as opposed to the *Phase Current*, which is the rating for 6 and 8 lead motors.

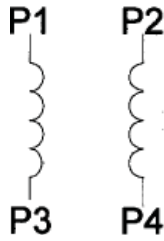


Figure 6: Series Motor Connection

## 6 Lead Motors

When configuring a 6 lead motor in a **half-coil configuration** (connected from one end of the coil to the center tap), multiply the specified per Phase (or unipolar) current rating by 1.4 to determine the current setting potentiometer value. This configuration will provide more torque at higher speeds when compared to the series configuration.

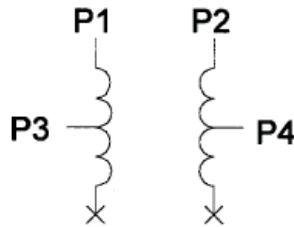


Figure 4: Half Coil Motor Connection

When configuring the motor in a **series configuration** (connected from end to end with the center tap floating) use the specified per Phase (or unipolar) current rating to determine the current setting potentiometer value.

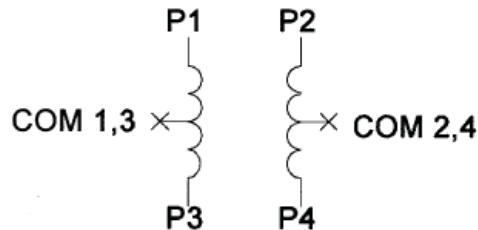


Figure 5: Series Motor Connection

## 8 Lead Motors

**Series Connection:** When configuring the motor windings in series, use the per Phase (or unipolar) current rating to determine the current setting potentiometer value.



Figure 7: Series Motor Connection

**Parallel Connection:** When configuring the motor windings in parallel, multiply the per Phase (or unipolar) current rating by 2.0 to determine the current setting potentiometer value.

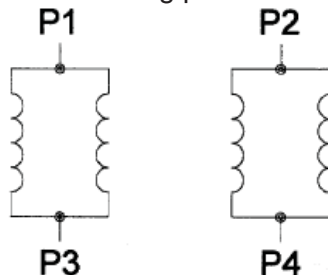


Figure 8: Parallel Motor Connection



**Note:** After the current has been determined, according to the motor connections above, use Table 6 to choose the proper setting for the current setting potentiometer.

## Connecting the Step Motor

Phase 1 and Phase 3 of the step motor are connected to pins 1 and 2 on connector TB2. Phase 2 and Phase 4 of the step motor are connected to pins 3 and 4 on connector TB2. The Motors case can be grounded to pin 5 on connector TB2. Refer to Figures 1 & 2 for TYPICAL APPLICATION HOOK-UP.

**Note:** The physical direction of the motor with respect to the direction input will depend on the connection of the motor windings. To reverse the direction of the motor with respect to the direction input, switch the wires on Phase 1 and Phase 3.

**WARNING:** Do not connect or disconnect motor wires while power is applied!

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