User's Manual

For

H420/HA335

High Performance Full/Half Step Driver

Version 3.3

Attention: Please read this manual carefully before using driver!

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1. Introduction, Features and Applications

H420/HA335 are high performance full/half step driver based on the most advanced technology in the world today. It is suitable for driving any 2-phase and 4-phase hybrid step motors(current 2A/3.5A). By using advanced bipolar constant-current chopping technique, it can output higher speed and more power from the same motor, compared with traditional technologies.

Features of this driver

- High performance, low cost
- Supply voltage to 40VDC; current to 2A for H420, 3.5A for HA335
- Inaudible 20khz chopping frequency
- TTL compatible and optically isolated input signals
- Automatic idle-current reduction
- Full/half step selectable
- Suitable for any 2-phase or 4-phase stepping motor under 2A/3.5A phase current (workable for 4,6,8 leads motor)
- Small size (95x76x45 mm for H420, 132x76x45 mm for HA335) for easy mounting

Applications of this driver

Suitable for a wide range of stepping motors and usable for various kinds of machines, such as labeling machines, laser cutters, laser labeling, graph plotter, small engraving machine, CNC, pick-place instrument and etc.

2. Specifications and Operating Environment

Electric Specifications (T_j = 25℃)

Parameters	H420/HA335			
	Min	Typical	Max	Remark
Peak Output Current	0.3/0.49A	-	2.0/3.5A	By DIP switch
Supply voltage (DC)	+18V	+36V	+40V	
Logic signal current	6mA	10mA	20mA	
Pulse input frequency	0	-	20KHz	5Mhz optional
Isolation resistance	500MΩ			

Operating Environment and Parameters

Coolant	Natural cooling or forced convection	
Environment	Space	Avoid dust, oil frost and corrosive gas
	Temperature	0 ° — 50℃
	Humidity	40 — 90%RH
	Vibration	5.9m/s^{2}Max
Storge Temp.	-20℃ — +65℃	
Weight	About 0.35kg/H420; 0.50kg/HA335	

Mechanical Dimensions

Unit: mm

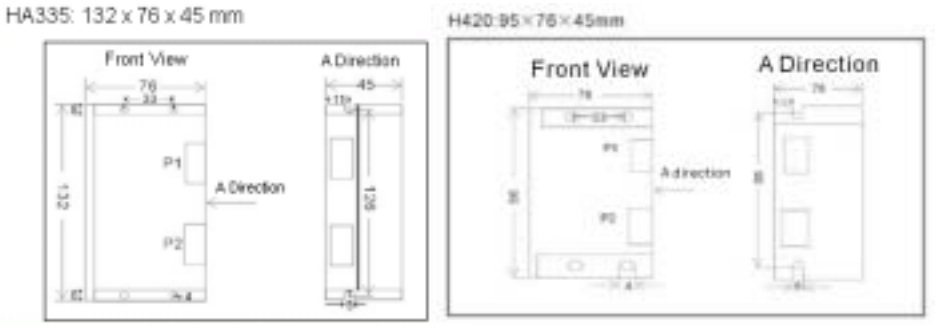


Figure 1: Mechanical dimensions

3. Driver Connectors, P1 and P2

The following is a brief description of the two connectors of the driver.

Control Signal Connector H420 P1-pins

Pin No.	Signal	Functions
1	PUL	effective for each upward rising edge; motor runs a step when pulse changed from low to high
2	DIR	Motor reverse signal used to change motor direction, TTL level driving.
3	OPTO (+5v)	Opto-isolated power supply: connect +5V voltage external. Drivable between +5V to +24V, please refer to chapter ten "Input signal" when voltage more than +5V, and please pay attention to current limitation.
4	ENA	Enable signal: this signal is used for enable/disable, high level for enabling driver and low level for disabling driver. Usually left unconnected(enabled).

Control Signal Connector HA335 P1-pins

Pin No.	Signal	Functions
1	PUL+ (+5V)	Pulse signal: in common anode connection mode, connect PUL+ to external voltage +5V, PUL- to pulse signal control terminal, effective for upward rising edge; in common cathode connection mode, connect PUL- to external GND, PUL+ to pulse signal control terminal, effective for upward rising edge. Pay attention that this connection must think of drive ability of control terminal.
2	PUL- (PUL)	
3	Dir+ (+5V)	Direction signal: high/low level control motor's direction, NA equal to high level. In common anode connection mode, connect DIR+ to external voltage +5V, DIR- to direction signal control terminal. In common cathode connection mode, connect DIR- to external GND, DIR+ to direction signal control terminal. Pay attention that this connection must think of drive ability of control terminal.
4	Dir- (Dir)	

Remark: Please note motion direction is also related to motor-driver wiring match. Exchanging the connection of two wires for a coil to the driver will reverse motion direction. (for example, reconnecting motor A+ to driver A- and motor A- to driver A+ will invert motion direction).

Power connector P2 pins

Pin No.	Signal	Functions
1	Gnd	DC power ground
2	+V	DC power supply, +18VDC － +40VDC, Including voltage fluctuation and EMF voltage.
3	Phase A	Motor coil A (leads A+ and A-)
4	Phase B	Motor coil B (leads B+ and B-)

4. Power supply

It is important to choose appropriate power supply to make the driver operate properly.

Maximum Voltage Input:

The power Mosfet inside the driver can actually operate within +18V－+40VDC, including power input fluctuation and back EMF voltage generated by motor coils during motor shaft deceleration. Higher voltage will damage the driver. Therefore, it is suggested to use power supplies with theoretical output voltage of no more than +40V, leaving room for power line fluatuation and Back EMF.

Regulated or Unregulated power supply:

Both regulated and unregulated power supplies can be used to supply DC power to the driver. However, unregulated power supplies are preferred due to their ability to withstand current surge. If regulated power supply (such as most switching supplies.) is indeed used, it is important to have large current output rating to avoid problems like current clamp, for example using 4A supply for 3A motor-driver operation. On the other hand, one may use a power supply of lower current rating than that of motor (typically 50%～70% of motor current). The reason is that the driver draws current from the power supply capacitor only during the ON duration of the PWM cycle, but not during OFF duration. Therefore, the average current withdrawn from power supply is considerably less than motor current. For example, 2 3A motors can be well supplied by one power supply of 4A rating.

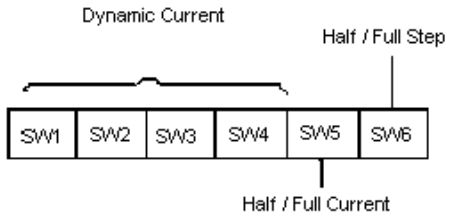
Multiple drivers:

It is recommended to have multiple drivers to share one power supply to reduce cost, provided that the supply has enough capacity. **DO NOT** dazy-chain the power supply input pin of the

drivers(connect them to power supply separately) to avoid cross interference.
Higher supply voltage will allow higher motor speed to be achieved, at the price of more noise and heating. If the motion speed requirement is low, it's better to use lower supply voltage to improve noise, heating and reliability.
NEVER connect power and ground in the wrong, it will damage the driver.

5. Selecting Half/Full Step and Current

This driver uses an 6-bit DIP switch to set half / full step and current, as shown below:



- **Half / Full Step Selection**

The 6th bit of DIP switch determine driver's working mode. When the switch set to be OFF, it is HALF step working mode, ON for FULL step working mode.

- **Current Setting**

The first 1-4 bits (SW1, 2, 3, 4) of the DIP switch are used to set the current during motion (dynamic current), while SW5 is used to select standstill current.

H420/HA335 DIP Setting for current during motion:

Current for H420	Current for HA335	SW1	SW2	SW3	SW4
0.29A	0.49A	On	Off	On	On

0.42A	0.70A	Off	Off	On	On
0.60A	1.00A	On	On	Off	On
0.72A	1.20A	Off	On	Off	On
0.88A	1.47A	On	Off	Off	On
1.00A	1.67A	Off	Off	Off	On
1.09A	1.82A	On	On	On	Off
1.22A	2.03A	Off	On	On	Off
1.50A	2.50A	Off	Off	On	Off
1.80A	3.00A	Off	On	Off	Off
1.99A	3.30A	On	Off	Off	Off
2.00A	3.50A	Off	Off	Off	Off

Noted that due to motor inductance the actual current in the coil may be smaller than the dynamic current settings, particularly at higher speeds.

DIP setting for current during standstill:

SW5 is used for this purpose, current setting due to coil inductance. OFF meaning that the standstill current is set to be half of the dynamic current, and ON meaning that standstill current is set to be the same as dynamic current.

6. Control Signal Connector (P1) Interface

This driver uses differential inputs to increase noise immunity and interface flexibility. Single-ended control signals from the indexer/controller can also be accepted by this interface. The input circuit has built-in high-speed opto -coupler, and can accept signals in the format of line driver, open-collector, or PNP output. Line driver (differential) signals are suggested for reliability. In the following figures, connections to open-collector and PNP signals are illustrated.

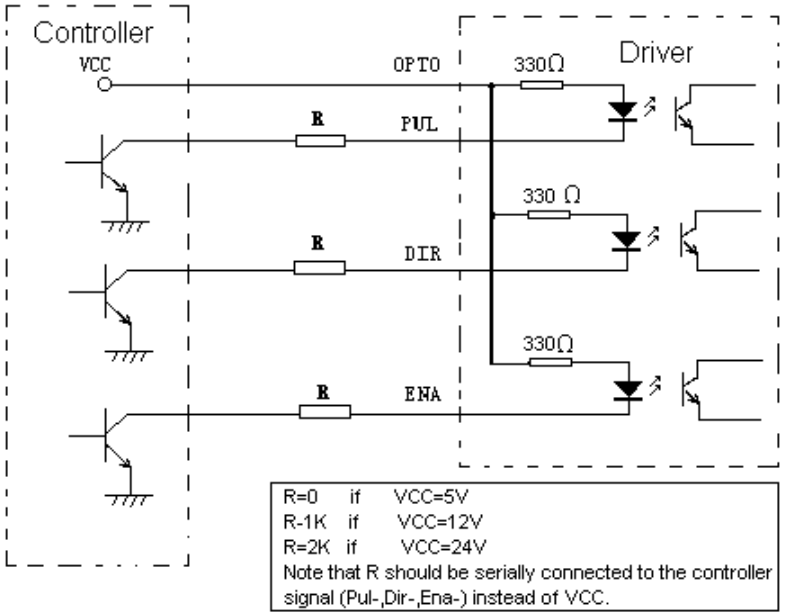


Figure 2: H420 Input Interface Circuit

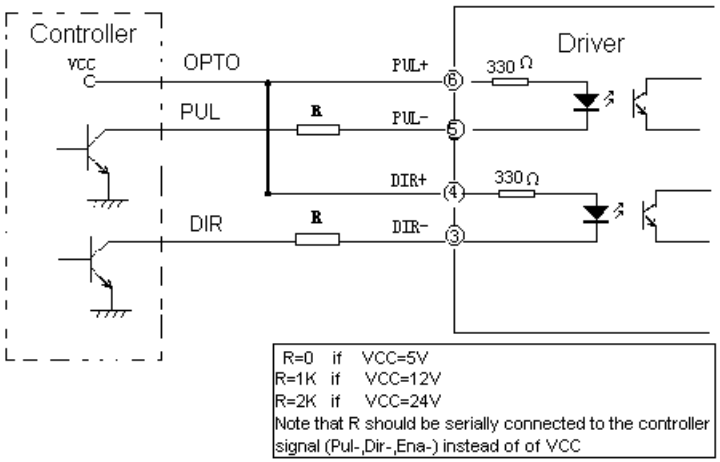


Figure 3: HA335 Input Interface Circuit PNP (common anode)

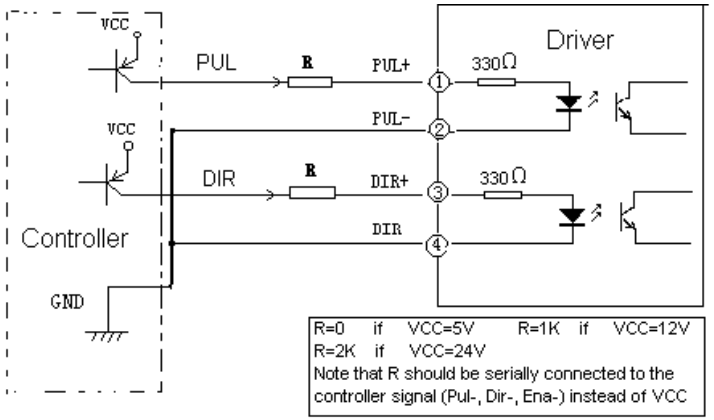


Figure 4: HA335 Input Interface Circuit NPN (common cathode)

7. Driver Connection to Step Motors

H420/HA335 driver can drive any 4, 6, 8 lead hybrid step motors. The following diagrams illustrate connection to various kinds of motor leads:

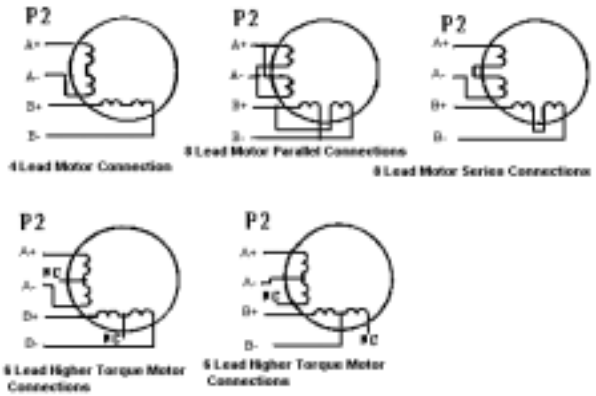


Figure 5: Driver Connection to Step Motor

Note that when two coils are parallelly connected, coil inductance is reduced by half and motor speed can be significantly increased. Serial connection will lead to increased inductance and thus the motor can be run well only at lower speeds.

7.1 Connecting to 8-Lead Motors

8 lead motors offer a high degree of flexibility to the system designer in that they may be connected in series or parallel, thus satisfying a wide range of applications.

Series Connection

A series motor configuration would typically be used in applications where a higher torque at lower speeds is required. Because this configuration has the most inductance, the performance will start to degrade at higher speeds. Use the per phase (or unipolar) current rating as the peak output current, or multiply the bipolar current rating by 1.4 to determine the peak output current.

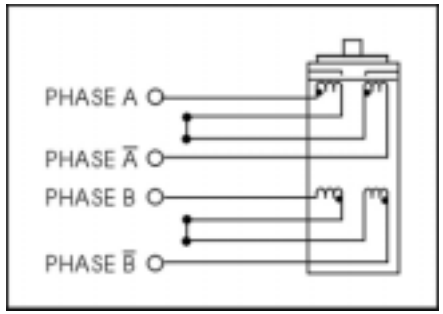


Figure 6: 8 Lead Motor Series Connections

Parallel Connection

An 8 lead motor in a parallel configuration offers a more stable, but lower torque at lower speeds. But because of the lower inductance, there will be higher torque at higher speeds. Multiply the per phase (or unipolar) current rating by 1.96, or the bipolar current rating by 1.4, to determine the peak output current.

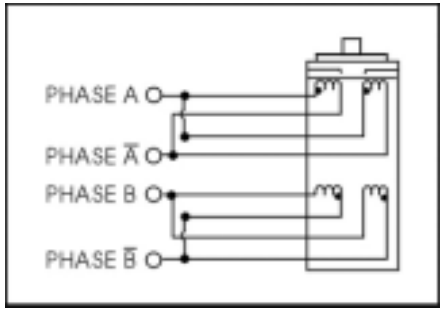


Figure 7: 8 Lead Motor Parallel Connections

7.2 Connection to 6-Lead Motors

Like 8 lead stepping motors, 6 lead motors have two configurations available for high speed or high torque operation. The higher speed configuration, or balf coil, is so described because it uses one half of the motor's inductor windings. The higher torque configuration, or full coil, use the full windings of the phases.

Half Coil Configuration

As previously stated, the half coil configuration uses 50% of the motor phase windings. This gives lower inductance, hence, lower torque output. Like the parallel connection of 8 lead motor, the torque output will be more stable at higher speeds. This confi8guration is also referred to as bal copper. In setting the driver output current multiply the specified per phase (or unipolar) current rating by 1.4 to determine the peak output current.

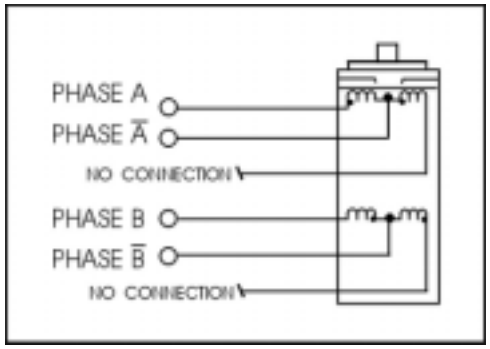


Figure 8: 6 Lead Half Coil (Higher Speed) Motor Connections

Full Coil Confuguration

The full coil configuration on a six lead motor should be used in applications where higher torque at lower speeds is desired. This configuration is also referred to as full copper. Use the per phase (or unipolar) current rating as the peak output current.

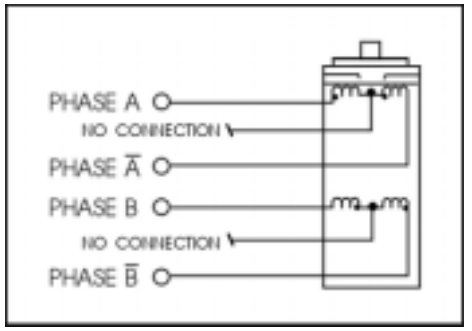


Figure 9: 6 Lead Full Coil (Higher Torque) Motor

7.3 Connection to 4-Lead Motors

4 lead motors are the least flexible but easiest to wire. Speed and torque will depend on winding inductance. In setting the driver output current, multiply the specified phase current by 1.4 to determine the peak output current.

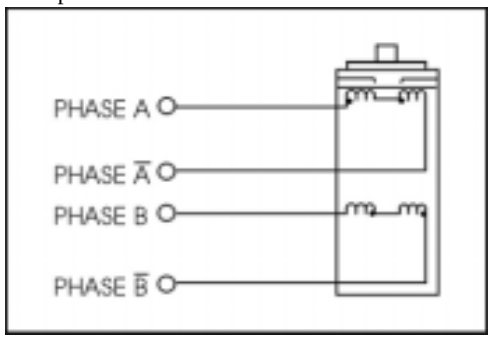


Figure 10: 4 Lead Motor Connections

8 Connection Diagram for Driver, Motor, Controller

A complete stepping system should include stepping motor, stepping driver, power supply and controller (pulse generator).
A typical connection is shown below:

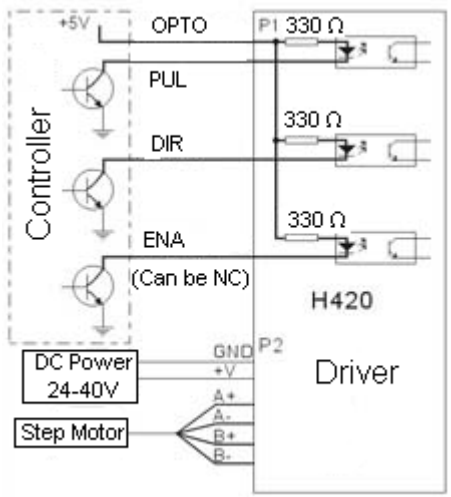


Figure 11: Driver connection in a stepping system (H420)

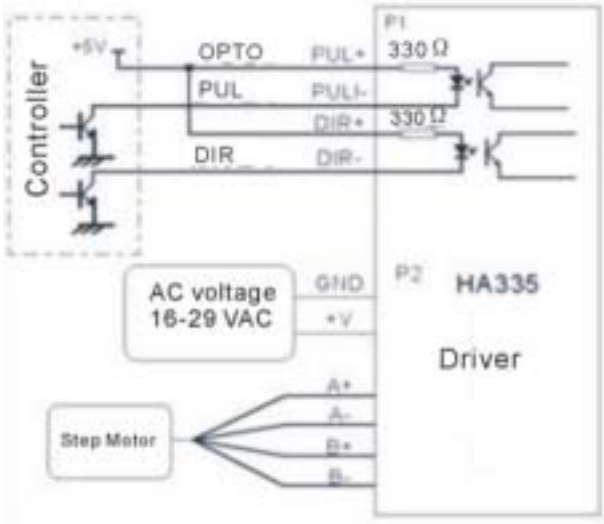


Figure 12: Driver connection in a stepping system (HA335)

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EXCLUSIVE REMEDIES

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