

Instructions on Brushless DC Water Pumps' Speed Control

0-5V and PWM speed control operation instructions



Applicable modes for 0-5V or PWM speed control functions

D5
series

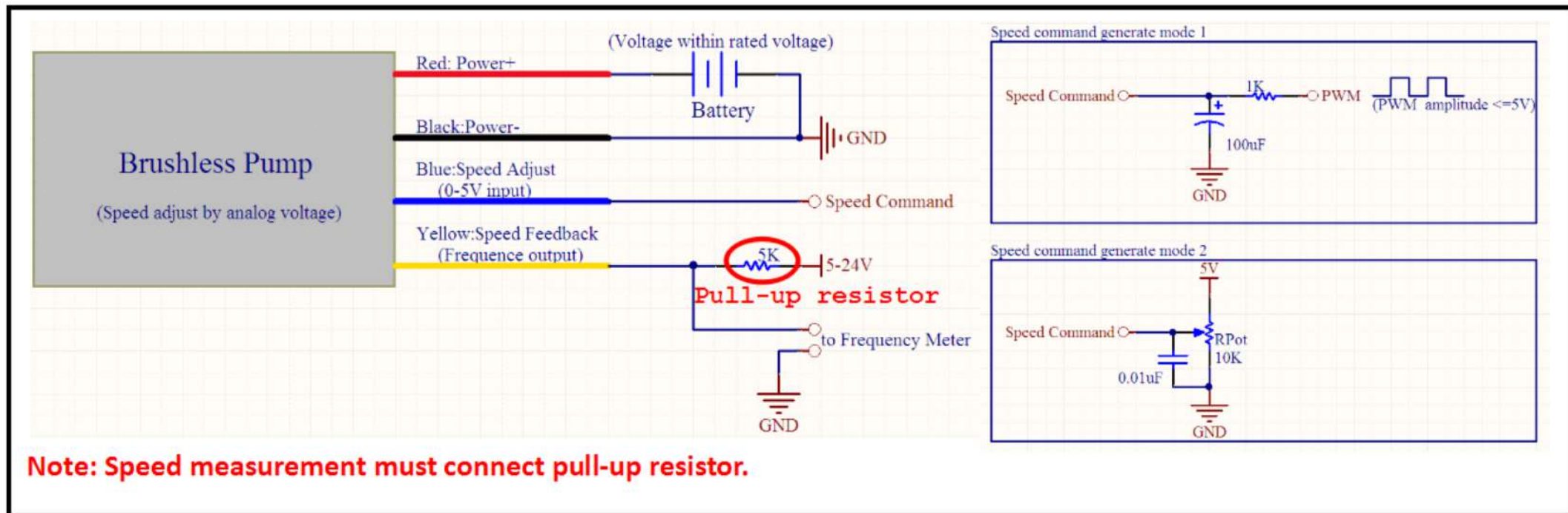
B10
series

C01
series

A6 series (PPS)
C2

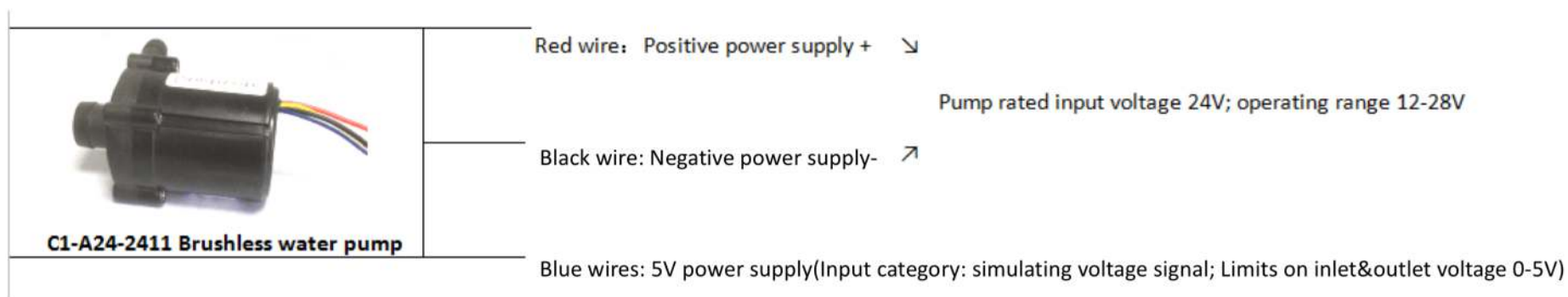


Wiring Diagram of Brushless DC Water Pumps' 5V Speed Control



Instructions on Diagram of Brushless DC Water Pumps' 5V Speed Control

Take C1-A24-2411 for example:



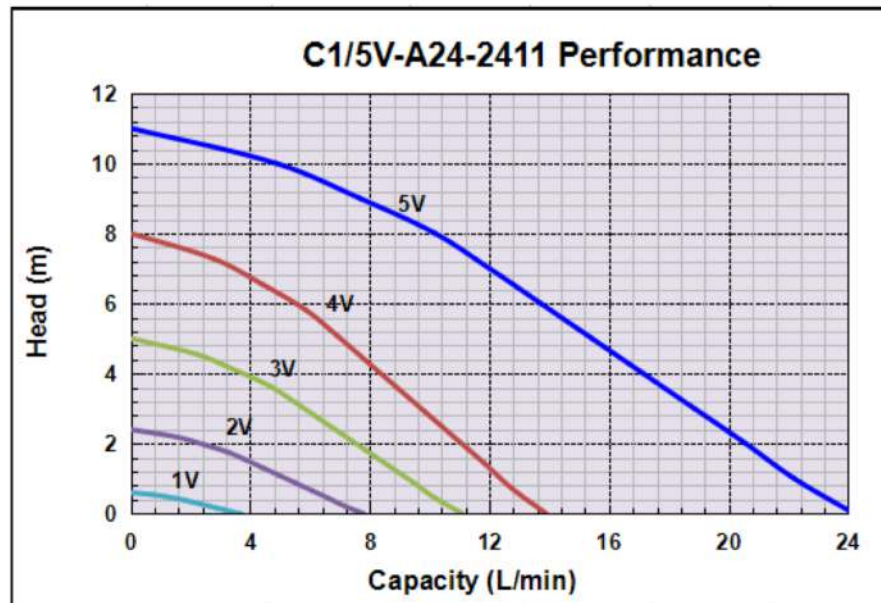
5V Control Specifications:

- ◇ 0-0.5V pump stops;
- ◇ 0.6V-5V pump speed increases by linearly;
- ◇ 5V pump works at full speed.

Operating instructions:

- ✓ 1, Pump works normally with red, black and blue wires connected simultaneously;
- ✗ 2, Pump does not work if the blue wire is not connected;
- ✗ 3, Pump would work for a while if black and red wires are connected, while blue wire is occasionally connected with 5V power supply;
- ✗ 4, pump is likely to be burned out if blue wire is powered by voltage over 5.5V.

C1/5V-A24-2411 performance curve under different voltage input within 0-5V



Conclusions:

C1/5V-A24-2411 DC Water Pump can be customized with 0-5V speed control function as the following controlling way:

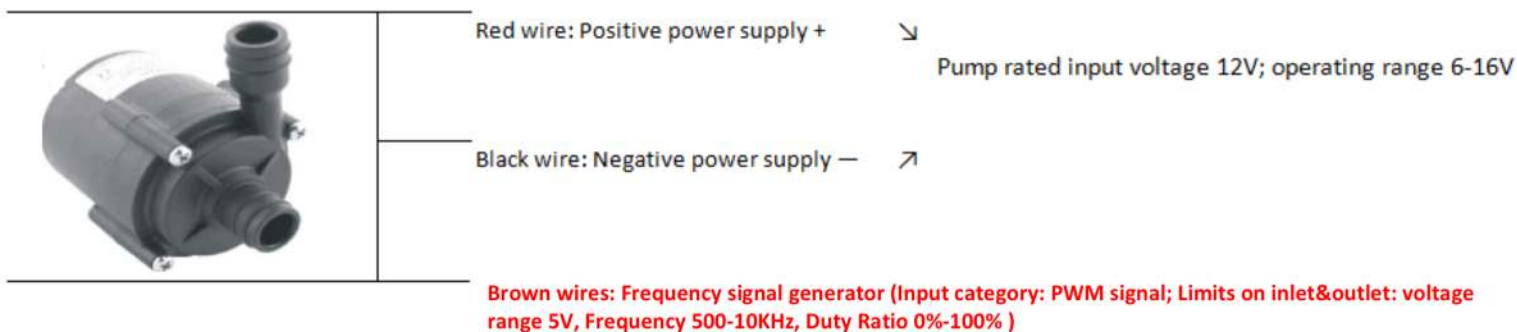
- ▶ 0-0.5V pump does not work;
- ▶ 0.6V-5V pump speed increases by linearly;
- ▶ 5V pump works at full speed.

0-5V wiring precautions

No.	Wrong wiring cases	Consequences	Correct wiring connection
1	Reverse positive and negative power supply	Pumps without polarity protection will be burned	Red connected to the positive, black negative plus
2	Speed port is connected to power source directly	Pump will be burned if power supply is > 5V	Only voltage signal which is $\leq 5V$ can be connected
3	0-5V speed port is connected to PWM signal	Pump will work normally if voltage is $\leq 5V$	Only voltage signal which is $\leq 5V$ can be connected
4	Power supply is connected with AC power or DC power > DC30V	Pump will be burned	Accessing DC power within operating voltage range

Diagram on Brushless DC Water pumps' PWM speed control

Take C1/PWM-A12-1706 for example:



• Operating instructions:

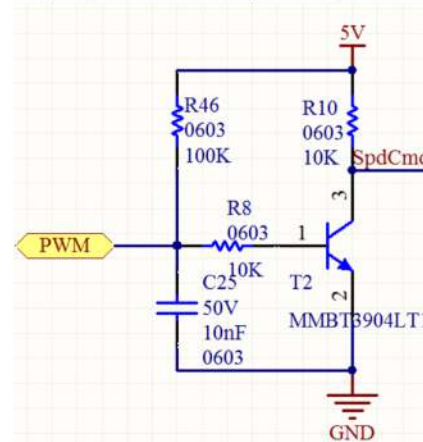
- ✓ 1, Pump works normally with red, black and brown wires connected simultaneously;
- ✗ 2, Pump does not work if the brown wire is not connected;
- ✗ 3, pump is likely to be burned out if brown wire is powered by voltage over 5.5V .

- ◆ Frequency range: 100-10K Hz
- ◆ Recommended frequency: 1K Hz
- ◆ High level range: 5V; Low level range: 0-0.5V (not related to pump rated voltage)
- ◆ Duty Ratio: Pump stops within 0-12% ; speed adjustable from lower to higher within 12%-100%; Work at full speed at 100%.

Remark: All above instructions are only applicable for B10, C1, C2 series, without A6/PWM (PPS) series included.

Exception: A6(PPS) PWM Frequency Range 100Hz-500Hz

1, It is ok to adopt an open collector output, as we have pull-up resistor in our pump motor. Here is a interface circuit for your reference:



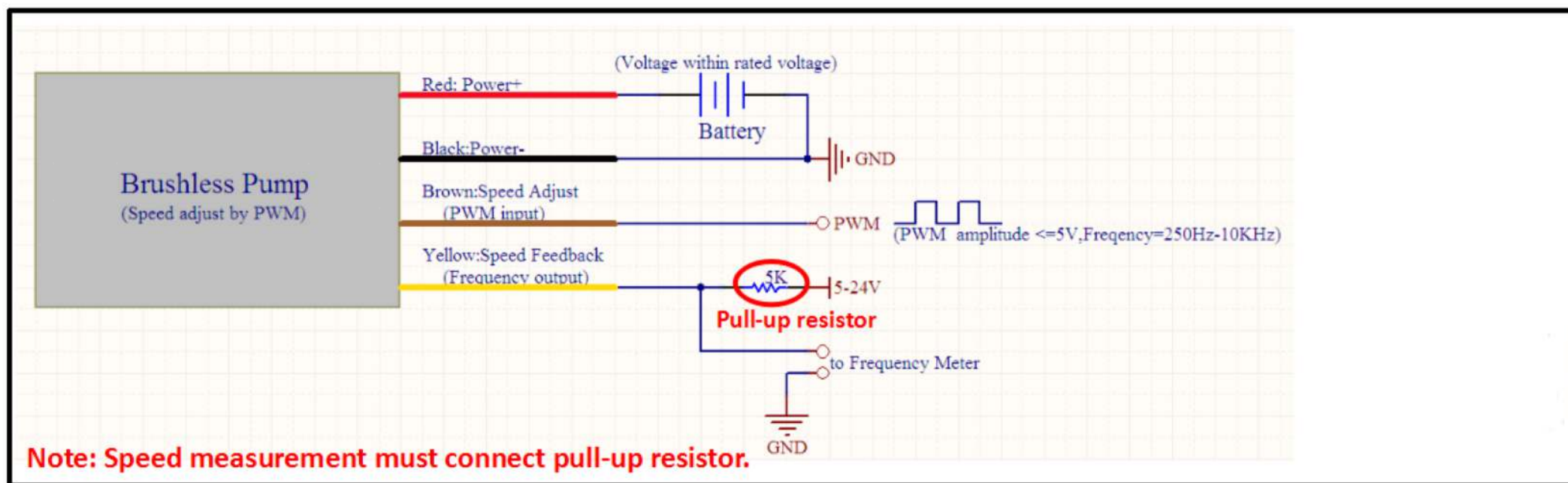
2, It is more suitable to adjust frequency range of PWM within 100Hz-500Hz. Different from normal pump modes, A6 circuit has been changed in the following 2 points:

- The PWM input uses the positive voltage duty cycle of the measurement pulse to obtain the speed command; As usual, the pulse is strongly filtered to become a voltage signal, and then the voltage is measured to obtain the speed command.
- Based on above point, the frequency of PWM has to be dropped.

3, So it is recommended to input frequency 100HZ-500H to A6 pump for speed control and product will be better in anti-interference ability.

4, Currently, stop mode has not been set for A6/PWM series.

Wiring Diagram of Brushless DC Water Pumps' PWM Speed Control



Although the pump can run at some frequency and speed can be controlled, the internal signal is abnormal (as shown in Figure 2). Besides, long-term operation will quickly reduce the pump life, finally burnout.

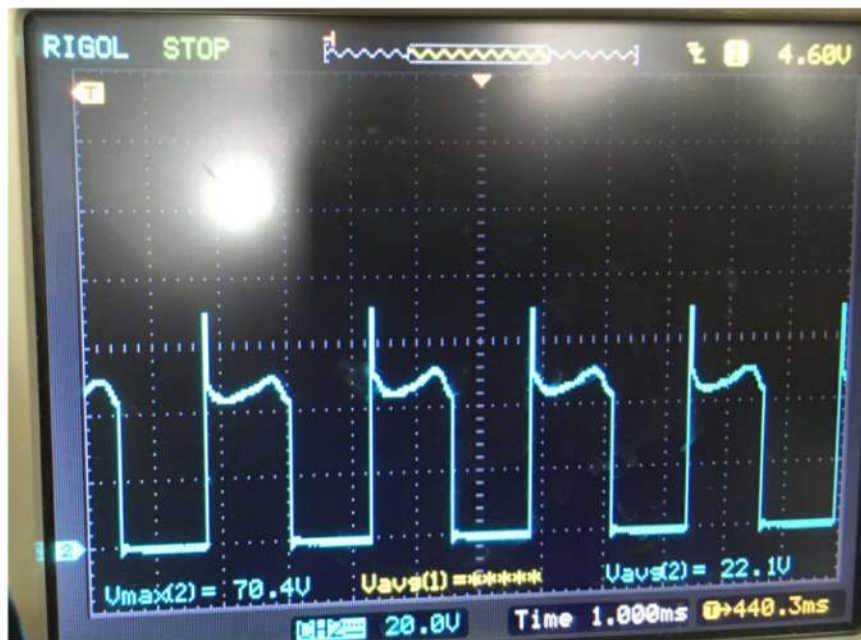


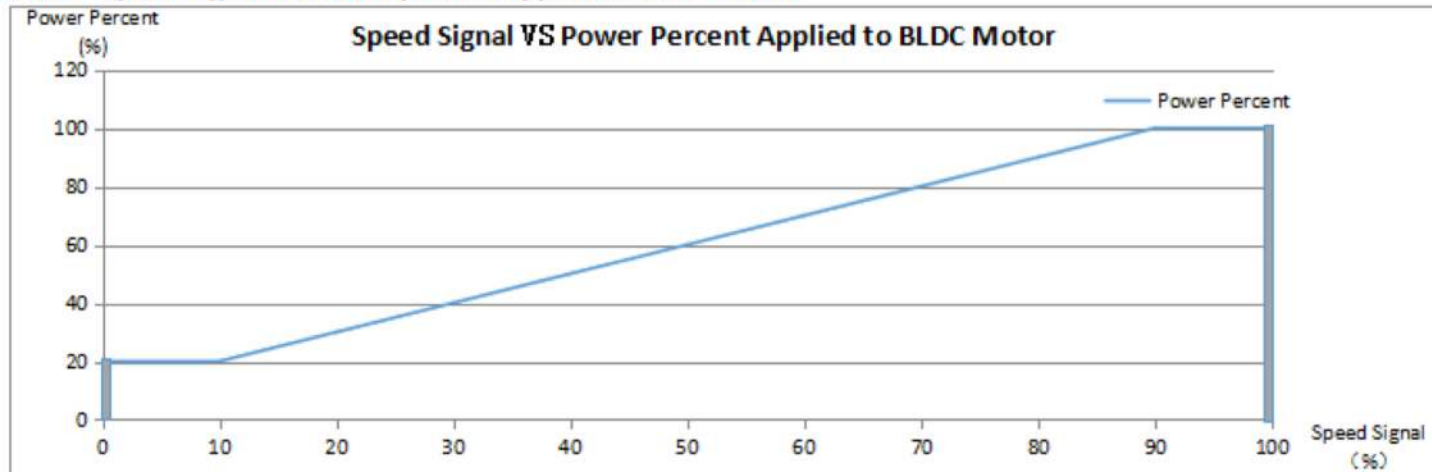
Figure 1: Pump's waveform under normal operation



Figure 2: Pump's waveform under PWM modulation, but without customized PWM function

A6/PWM-R12-3409 Performance Curve Under Different Speed Signal (PWM Duty Cycle)

Curve1 : Speed signal VS Power percent applied to BLDC Motor



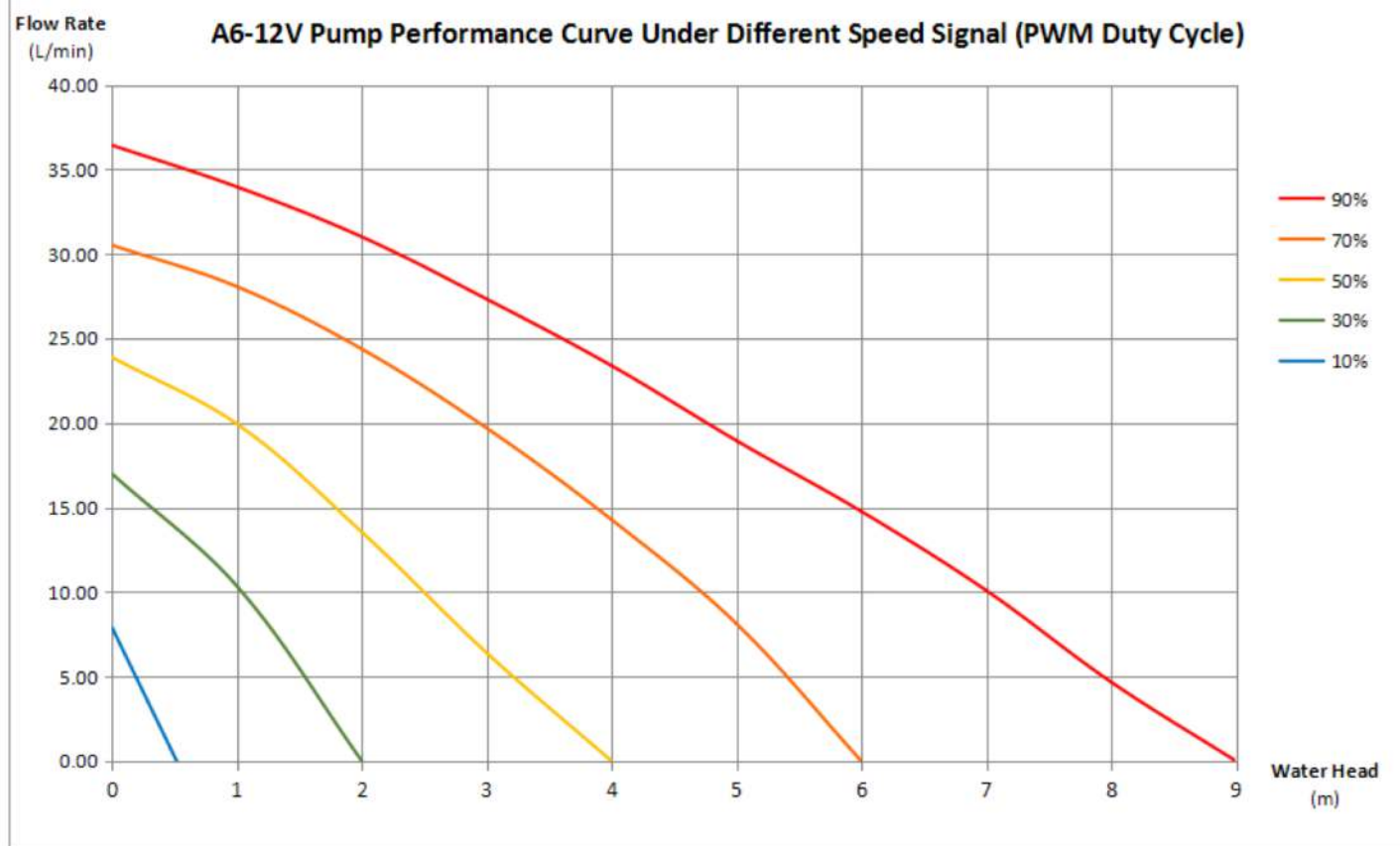
Note 1: It should be noticed that don't set PWM duty cycle to <2% or >98%, Pump maybe make a wrong action.

Note2: To make the Pump easy to use for the application without PWM generator, a low level signal(equal to 0%duty) make pump lowest speed running, and a high level signal(equal to 100%duty) will make pump full speed running.

Note3: It is recommended that using PWM signal with frequency of 100 - 500Hz and amplitude of 5V.

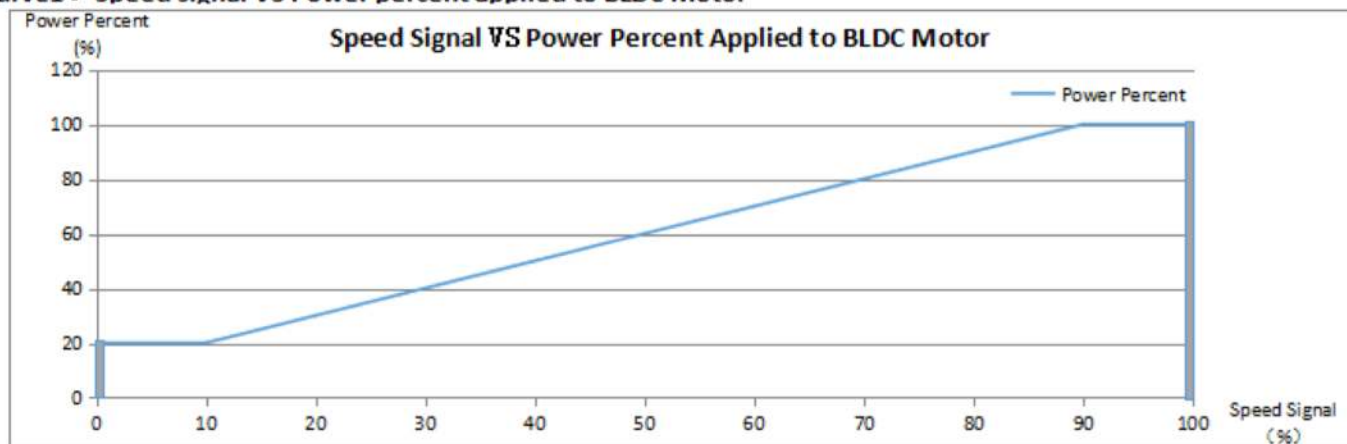
A6/PWM-R12-3409 Performance Curve Under Different Speed Signal (PWM Duty Cycle)

Curve 2: A6-12V Pump Performance Curve Under Different Speed Signal (PWM Duty Cycle)



A6/PWM-R24-3709 Performance Curve Under Different Speed Signal (PWM Duty Cycle)

Curve1 : Speed signal VS Power percent applied to BLDC Motor



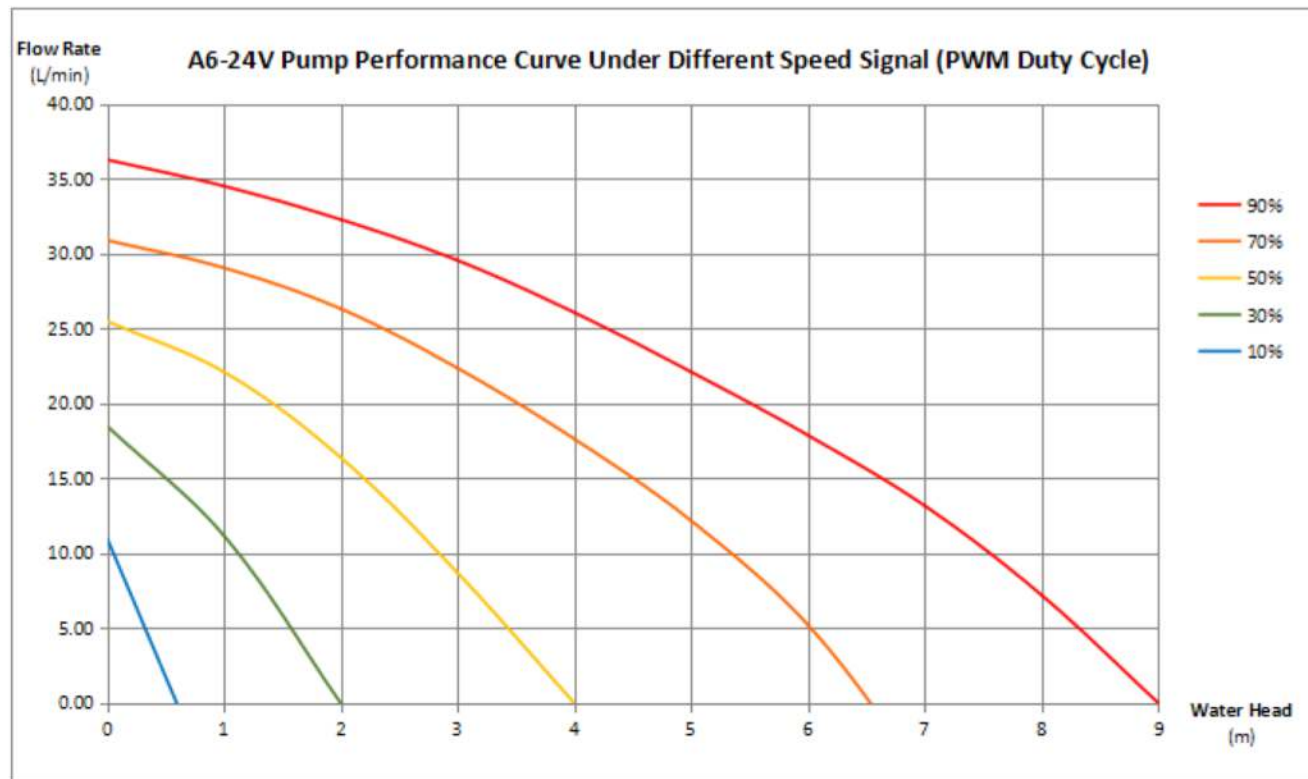
Note 1: It should be noticed that don't set PWM duty cycle to <2% or >98%, Pump maybe make a wrong action.

Note2: To make the Pump easy to use for the application without PWM generator, a low level signal(equal to 0%duty) make pump lowest speed running, and a high level signal(equal to 100%duty) will make pump full speed running.

Note3: It is recommended that using PWM signal with frequency of 100 - 500Hz and amplitude of 5V.

A6/PWM-R24-3709 Performance Curve Under Different Speed Signal (PWM Duty Cycle)

Curve 2: A6-24V Pump Performance Curve Under Different Speed Signal (PWM Duty Cycle)



PWM Wiring Precautions

No.	Wrong wiring cases	Consequences	Correct wiring connection
1	Reverse positive and negative power supply	Pumps without polarity protection will be burned	Red connected to the positive, black negative plus
2	PWM speed port is connected to power source directly	Pump will be burned if power supply is over 5V	Only PWM signal which is $\leq 5V$ can be connected
3	PWM speed port is connected to 0-5V signal	Pump will work normally if voltage is $\leq 5V$	Only PWM signal which is $\leq 5V$ can be connected
4	Power supply is connected with AC power current or DC power > DC30V	Pump will be burned	Accessing DC power within operating voltage range