# NU-BL5020-01

## 1KW (50V 20A) Brushless Motor Drive

## 1.FEATURES

1. **Four different control modes:**
   - Hall sensor based open loop control
   - Hall sensor based closed-loop control
   - Sensorless open-loop control
   - Sensorless closed-loop control


2. **Multiple Speed input signals：**
   - On-board potentiometer speed input
   - Analogue Speed input
   - PWM Speed input
   - RS485 Modbus Speed input

3. **Multiple Protections schemes：**
   - Over-voltage protection
   - Under-voltage protection
   - Over-current protection
   - Motor Stall protection
   - Hall sensor error protection

4. **Speed Ramp Implementation**
   For speed and direction change, to protect motor
   and drive.

5. **Speed Feedback signal**

6. **Error Feedback signal and LED**

7. **RS-485 MODBUS RTU protocol for serial control**

## 2.CHARACTERISTICS

| PARAMETER | DATA |
|---|---|
| **Operating Voltage** | 18VDC~50VDC |
| **Output Current (Continuous)** | 20A |
| **Output Current (Maximum)** | 25A |
| **Maximum Power** | 1000W |
| Cooling method | Natural air cooling or forced air cooling |
| Environment | Avoid dust, oil mist and corrosive gases |
| Operating Temperature | 0℃～+50℃ |
| Humidity | < 80%RH，no condensation, no frost |
| Vibration | < 0.5G（4.9m/s$^2$ ）10Hz-60Hz (non-continuous operation) |
| Storage Temperature | -20℃～+65℃ |
| Dimensions | 143mm*80mm*33mm |
| Weight | 326g |

## 3.INTERFACE

| FUNCTION | SIGN | DESCRIPTION |
|---|---|---|
| Serial | PC-IN | RJ45 connect RS485 |
| | RS485-A | RS485 interface A port |
| | RS485-B | RS485 interface B port |
| Control | RV | On-board speed input potentiometer |
| | ALM | Alarm signal output. The output level changes from high to low when an alarm occurs. |
| | SPEED | Speed feedback signal output. |
| | X | Reserve |
| | EN | Enable/Disable signal input. High (or left unconnected) to enable the drive; Low (connected to Ground) to disable the drive. |
| | F/R | Direction control signal input. High (or left unconnected) to drive the motor in one direction; Low (connected to Ground) to drive the motor at the other direction. |
| | COM | Control signal Ground (internally connected to Power Ground). |
| | SV | External speed control signal input. |
| Hall Signal | 5V | 5V output |
| | HU | Hall sensor signal U phase input |
| | HV | Hall sensor signal V phase input |
| | HW | Hall sensor signal W phase input |
| | GND | Hall power GND |
| Motor and Power | U | Motor's U phase |

| | | |
|---|---|---|
| | V | Motor's V phase |
| | W | Motor's W phase |
| | GND | Supply power input - |
| | VIN | Supply power input +（18VDC~50VDC） |

***Note：The drive is not polarity protected, please double-check the power connection before switch on the power input.***

# 4.FUNCTIONS

## 4.1 Control modes

The drive supports 4 drive mode. The DIP switch SW3 and SW4 are used to select the different drive mode. The control mode must be selected before power up.

| SW3 | SW4 | MODEL |
|---|---|---|
| ON | ON | Sensorless open loop model |
| OFF | ON | Hall open loop model |
| ON | OFF | Sensorless speed closed-loop model |
| OFF | OFF | Hall speed closed-loop model |

## 4.2 Speed inputs

The drive supports four different speed input signals. The external analogue and PWM inputs used the same input pin SV. In order to use external input signals, the on-board speed input signal must be switched off, by turning the on-board potentiometer counter-clockwise until the switch in the potentiometer is activated (User can hear a click sound when the switch is activated).

The input range of external analogue input in 0.1 – 5.0V DC, It is recommended to use the 5V and Ground output from the drive; and use 10KΩ -50KΩ potentiometer.

When PWM input is used, the duty cycle of the PWM signal is used as speed input. The recommended PWM signal is

- Frequency range: 5KHz - 20KHz
- Amplitude: 5VDC
- Duty cycle: 2% - 100%。

### 4.3 Speed feedback output

The speed feedback output signal outputs the speed signal at motor commutation frequency, $F_{comm}$. The motor speed (RPM) can be calculated as –

Motor Speed (RPM) $= F_{comm}$ /Pole_Pairs / 3 *60（RPM）

Where: $F_{comm}$: Speed feedback frequency (or Commutation frequency)
Pole_Pairs: Motor pole pairs
For example:
One 4 pole motor, the output signal is 300Hz.
Motor speed = 300 /2 /3× 60 = 3000 RPM.

### 4.4 Protection and Alarm

The drive implements multiple protection schemes to protect the drive and motor. When the protection condition is triggered, the drive switches of its motor outputs and drives ALM output low. The motor outputs remain switched off and the ALM output is kept low, until the recovery condition is met.

| PROTECTION | Trigger condition | Recover Condition |
|---|---|---|
| Over voltage | Input voltage > 53VDC | Input voltage <50V and speed input = 0 |
| Under voltage | Input voltage < 16VDC | Input voltage >18V amd speed input = 0 |
| Over current | Output current > 25A | Output current <20A and speed input = 0 |
| Over temperature | Temperature > 95℃ | Temperature <50℃ |
| Locked rotor | Time > 4s | Speed input = 0 |
| Hall error | Input hall signal error | Connect hall signal correctly |

***Note：Please disconnect the power supply when reconnecting the hall signal.***

There are one green LED and one red LED on the drive, marked as [RUN/ALM]. The green LED is a power indicator. The RED led is an error status indicator, it lit up to indicate different error conditions.

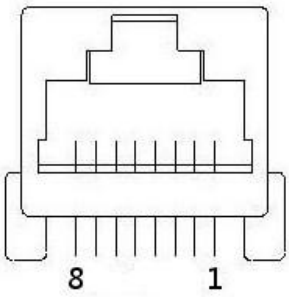
| STATUS | RED INDICATOR |
|---|---|
| Normal | Turn off |
| Over voltage | Blink once every second |
| Under voltage | Blink twice every second |
| Over current | Blink 3 times every second |
| Over temperature | Blink 4 times every second |
| Locked rotor | Blink 5 times every second |
| Hall error | Blink 6 times every second |

### 4.4 MODBUS protocol

The drive supports RS-485 MODBUS protocol (RTU mode). It supports 303 (0x03) – read holding register and 606 (0x06) – write single holding register. It supports baud rate range is 9600-256000bps（ factory default baud rate -- 115200 bps），8 data-bit，no parity and 2 stop bit.

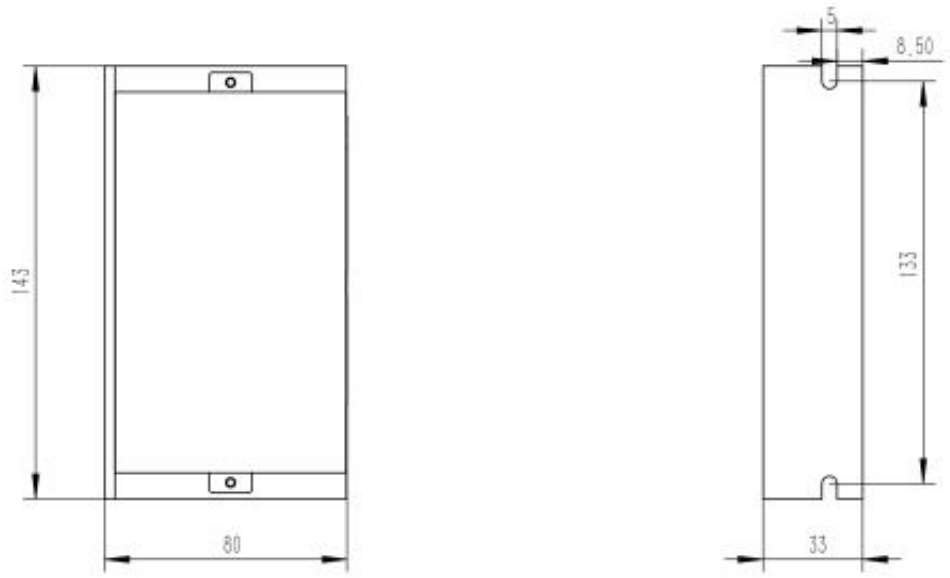
For detailed information on Modbus protocol, please refer to our Modbus protocol document.

MODBUS on RJ45 connector.




| | |
|---|---|
| 4 | RS485-B |
| 5 | RS485-A |
| 7 | 5V |
| 8 | GND |

# 5.DIMENSIONS



| REVISION HISTORY | | |
|---|---|---|
| Version | Date | Description |
| V1.0 | 2019/10/24 | Initial Release |
| V1.1 | 2020/04/16 | Added instructions of RJ45 connector |