Kelly KLS-N Series High Current Sinusoidal BLDC Motor Controllers User Manual

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Introduction

Overview

KLS-N HC is a variant of the standard KLS-N model, offering significant performance improvements in a larger size, while still maintaining the same IP66 protection. This manual introduces the features, installation, and maintenance of the Kelly sinusoidal brushless DC (BLDC) motor controller. Please read the manual carefully before using the controller. If you have any questions, contact the Kelly Controls support center. Kelly programmable motor controllers provide efficient, smooth, and quiet control for electric motorcycles, golf carts, go-karts, and industrial motor control. The primary design focus is to address noise issues in BLDC motor drive applications. The KLS-N motor controller must be used with Hall sensors and currently does not support sensorless brushless motors. Compared with the traditional trapezoidal control technology, this technology, based on sinusoidal drive technology, can reduce operating noise and switch loss by one-third, meeting the noise reduction and efficiency requirements of brushless DC motor applications. It uses high-power MOSFETs, SVPWM, and FOC, achieving up to 99% efficiency in most cases. A powerful microprocessor brings comprehensive and precise control to the controller. It also allows users to quickly and easily adjust parameters, conduct tests, and obtain diagnostic information. The KLS controller can be programmed on both PC software and Android apps. The KLS-N features user-friendly I/O terminals, allowing customers to easily connect the battery and motor.
Caution: Before running the motor, please start the auto-identification operation first. Do not attempt to connect the controller to the user program or change settings in the user program or Android App while the motor is still running. In other words, if you want to connect the controller to the user program or attempt programming, please stop the motor first. This is the most important thing.

Features and Specifications

General Functions

1. Extended fault detection and protection. Customers can read the error message in PC software or Android APP also.
2. Monitoring battery voltage. The controller will stop driving if the battery voltage is too high. When the battery voltage is low, it will progressively cut back motor drive power as the
   battery voltage drops. It will also stop driving if the battery voltage reaches the preset “Low Battery Voltage” value.
3. Built-in current loop and over-current protection.
4. Configurable motor temperature protection range.
5. Current cutback at low temperature and high temperature to protect battery and controller. The current begins to ramp down at 90℃ case temperature, shutting down at 100℃.

6. The controller keeps monitoring the battery recharging voltage during regen braking.
7. Maximum reverse speed and forward speed can be configured between 20% and 100% respectively and separately.
8. The controller can be programmed and configured using a user program or an Android app. For the PC side, please connect the controller and PC using a Kelly USB cable or a USB-RS232 set to use the user program. For the Android side, please connect the controller to a Bluetooth adapter purchased from our site to use the configuration app on Android devices.
9. Provision of a +5 volt and +12 volt output to supply various kinds of hall sensors and switches.
10. Multiple switch inputs. By default, the switch is effective when the voltage value is 12V.
11. 3 analog inputs (signal is 0-5V), the default is throttle analog input, brake analog input, and motor temperature input.
12. The controller will copy the pulse signal of the -phase Hall sensor for use in the pulse speedometer.
13. Configurable boost function. Enables the maximum motor output if the boost switch is turned on. Regardless of the throttle position, the effect will be the same as a full throttle.
14. Configurable joystick throttle. A bi-symmetrical 0-5V signal for both forward and reversing.
15. Configurable motor over-temperature detection and protection with the recommended thermistor KTY84-130/150 or KTY83-122.
16. Only support three-phase hall position sensors. Open collector, pull-up provided.
17. At the Brake analog regen mode, the controller needs another analog input as brake input.
18. Enhanced regen brake function. A novel ABS technique provides powerful and smooth regen. The regen can start at any speed.
19. Cruise control. Only can be activated in the forward direction.
20. Bluetooth supported. Required a Bluetooth adapter which needs to be purchased in addition from our website. This adapter is only useful for the KLS controller.
21. User customization on the serial port communication is supported.
22. CAN Bus (Optional), broadcast type, with a customizable baud rate(default at 250Khz). CAN bus is not included by default in KLS-N controllers.
23. Bidirectional anti-slip function (Optional), Prevent the stationary vehicle from moving in the opposite direction. After the function is enabled when the controller detects that the motor turns from a standstill to the opposite direction, it will drive the motor to provide some braking force, making the vehicle stop or slowdown The braking force can be set as required.
24. Pedal Assist System (Optional), assisting the rider when they pedal.
25. Electric-magnet brake (Optional).
26. Weak Magnetic Speed Boost Function (Optional).
27. Anti-theft function (Optional), an external alarm is required.
28. Built-in DC/DC Module (Optional), to supply external peripherals. (13.5V,2A)
29. Other functions required by the user, require additional customization.

    Caution: For safety reasons, regen must be used together with mechanical brakes.

Features

1. Smart Control with Powerful Microprocessor.
2. Synchronous rectification, ultra-low voltage drop, fast SVPW, M, and FOC for very high efficiency.
3. Electronic commutation.

4. Monitoring of 3 motor phases, power bus, and power voltage.
5. Monitoring of 12V and 5V voltage sources.
6. Detection of current in all 3 motor phases.
7. Current control loop.
8. Hardware overcurrent protection.
9. Hardware overvoltage protection.
10. Configurable motor current and battery current limits.
11. Low EMC.
12. Battery protection: current reduction, warning, and shutdown at configured high and low voltage levels.
13. The PCB is mounted on an aluminum base plate with a heat sink on the bottom of the controller.
14. Various connector sets support small signals, with waterproof connector set by default.
15. Thermal protection: current reduction, warning, and shutdown at high temperatures.
16. Automatic identification feature for Hall sensors mounted at any angle.
17. Configurable high pedal protection: if a high throttle is detected at startup, the controller will not operate.
18. Current multiplication: drawing less current from the battery while outputting more current to the motor.
19. Easy installation: Operates with Just a 3-Wire Potentiometer.
20. Programming via standard PC/laptop, user program provided. Easy to use. No cost to customers.
21. Supports motors with any number of poles.
22. Standard electrical speed up to 70,000 eRPM (electrical speed = mechanical speed * number of pole pairs; number of pole pairs = number of poles / 2).
23. Dust-proof and waterproof under sealed conditions, IP66.

Specifications

1. Frequency of Operation: 10KHz, 16KHz, 20KHz.
2. Standby Battery Current: < 0.5mA.
3. 5V or 12V Sensor Supply Current: 40mA.
4. Supply(PWR) Current: 30mA Typical.
5. Battery voltage(B+) range: Configurable.
6. Standard Throttle Input: 0-5V(3-wire resistive pot), 1-4V(hall active throttle).
7. Full Power Operating Temperature Range: 0℃ to 70℃(MOSFET temperature).
8. Operating Temperature Range: -40℃to 100℃ (MOSFET temperature).
9. Max Battery Current: Configurable.
10. Max Motor Current: Configurable.

Name Regulation
The name regulation of Kelly BLDC motor controllers: For example KLS7275NT

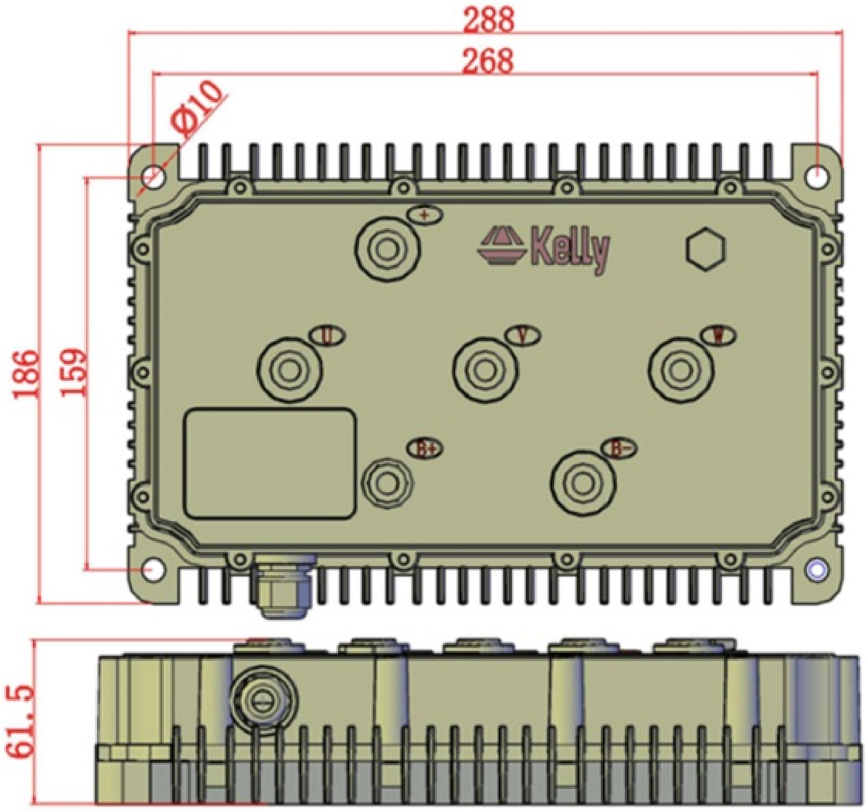
- **KLS**: Kelly BLDC motor controller based on sinusoidal waveform which is supposed to work with BLDC motor with three hall sensors. All KLS controllers can do the regen brake function by default.
- **72:** 72V battery pack.
- **N:** Large housing, providing better current performance.
- **NT:** Compact large housing, smaller and lighter compared to the N model. It has standard current performance.

Kelly KLS-N - Sinusoidal Brushless Permanent Magnet Motor Controller				
Model	Nominal Voltage	Max Operating Voltage	Peak Current 2 Minutes	Continuous Current
KLS4860NT	36-48V	27-60V	400A	160A-240A
KLS4875N	36-48V	27-60V	500A	200A-300A
KLS48100N	36-48V	27-60V	600A	240A-360A
KLS48120N	36-48V	27-60V	700A	280A-420A
KLS7275NT	48-72V	36-86V	450A	180A-270A
KLS7275N	48-72V	36-86V	500A	200A-300A
KLS72100N	48-72V	36-86V	600A	240A-360A
KLS72120N	48-72V	36-86V	700A	280A-420A
KLS72150N	48-72V	36-86V	800A	320A-480A
KLS8475N	48-84V	36-100V	500A	200A-300A
KLS84100N	48-84V	36-100V	600A	240A-360A
KLS84120N	48-84V	36-100V	700A	280A-420A

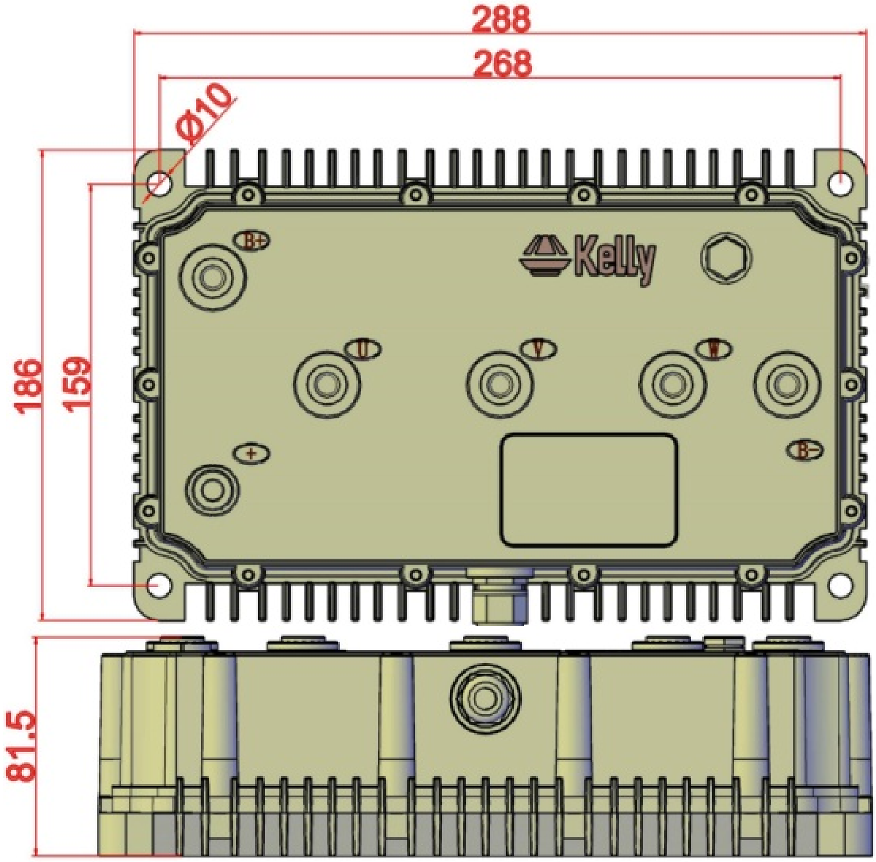
Wiring and Installation

Mounting the Controller

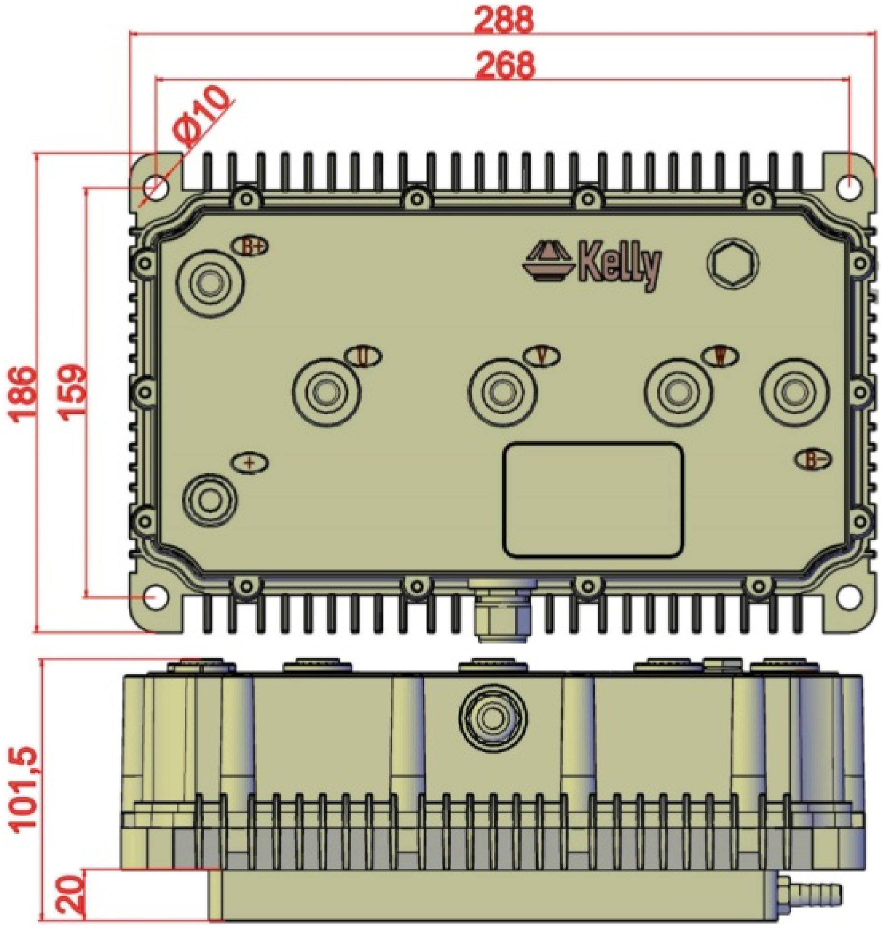
The controller can be placed anywhere but should be kept as clean and dry as possible. If necessary, cover with a cover to prevent water and contaminants from entering. To ensure full-rated output power, the controller should be mounted on a clean, flat metal surface and secured with screws on all four mounting holes. Apply silicone grease or other thermally conductive material to the contact surfaces to enhance thermal performance. Proper heat sinking and airflow are vital to achieve the full power capability of the controller. The case outline and mounting holes' dimensions are shown below.



KLS4860NT KLS7275NT mounting holes' dimensions (dimensions in millimeters) +/B+/B-/U/V/W: M8

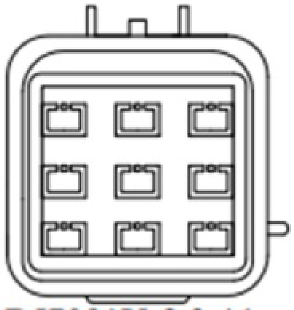


KLS4875N KLS48100N KLS48120N KLS7275N KLS72100N KLS72120N KLS72150N KLS8475N KLS84100N KLS84120N KLS84150N mounting holes' dimensions (dimensions in millimeters) +/B+/B-/U/V/W:M8



Within Aluminum Liquid Cooling Heatsink at the bottom mounting holes' dimensions (dimensions in millimeters) +/B+/B-/U/V/W: M8

Connections



DJ7091Y-2.3-11
See from output side

Orange REV-SW (14)	Black GND (6)	White FWD (12)
Red 12V (11)	Yellowish 12V Brake (25)	Blue ECO (22)
Greenish CAN_H (33)	Pink PWR (7)	Brownish CAN_L (34)

DJ7091Y-2.3-21
See from output side

Gray Foot_SW (15)	Green Throttle (3)	
Black GND (20)	D-Gray Meter (8)	
Purple 5V (4)	Brown Brake_AN (2)	Red 12V (11)

DJ7091Y-2.3-11 Pin Definition

1. REV_SW(14): Reverse switch input. ※Orange
2. GND(6): Signal return or power supply return. ※Black
3. FWD(12): Forward switch or can be enabled as a High-speed switch function. ※ White
4. 12V(11): 12V Supply. ※Red
5. 12V (25): brake switch. ※Yellowish
6. ECO(22): Low-speed switch. ※Blue
7. CAN-H(33): (Optional function). ※Greenish
8. PWR(7): Controller power supply (input). ※Pink
9. CAN-L(34): (Optional function). ※Brownish

DJ7091Y-2.3-21 Pin Definition

1. Foot_SW(15): Throttle switch input. ※Gray
2. Throttle(3): Throttle analog input, 0-5V. ※ Green
3. GND(20): Signal return. ※Black
4. Meter(8): Copied signal of hall-A sensor. ※Dark Gray
5. 5V(4): 5V Supply, <40mA. ※Purple
6. Brake_AN(2): Brake variable regen or Boost function. ※Brown
7. 12V(11): 12V Supply. ※Red

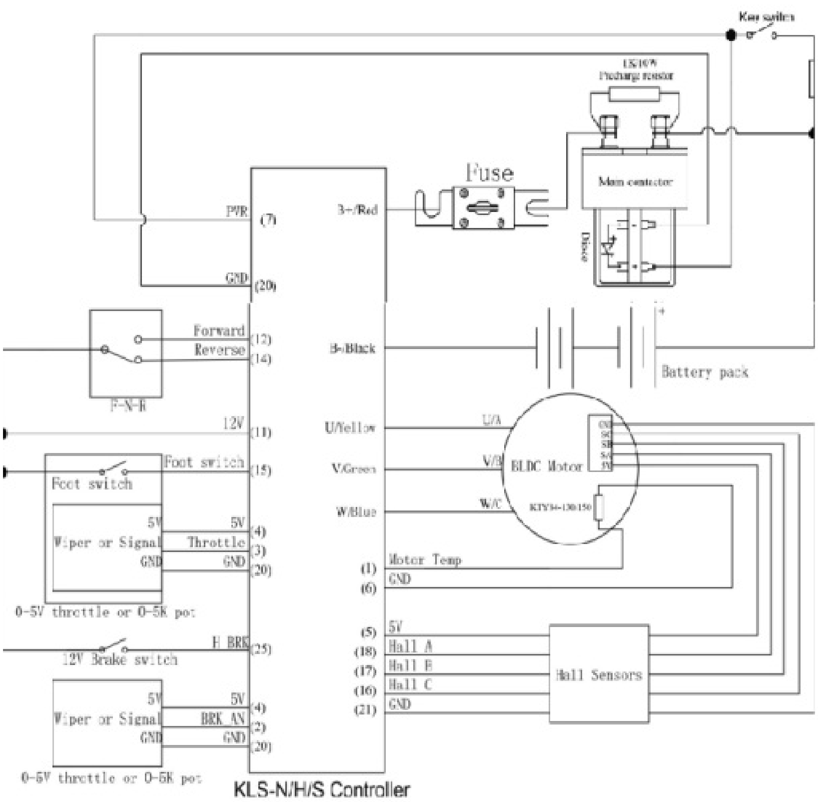
DJ7061Y-2.3-21 Pin Definition

1. GND(21): Signal return. ※Black
2. Temp(1): Motor temperature sensor input. ※Raddle.
3. 5V(5): 5V Supply, <40mA. ※Purple
4. Hall A(18): Hall sensor signal of phase-A. ※Yellow
5. Hall B(17): Hall sensor signal of phase B. ※Dark Green
6. Hall C(16): Hall sensor signal of phase C. ※Dark Blue

Notes

1. All GND pins are internally connected.
2. The meter function is to output the signal of the hall-A sensor.
3. Three gears and three speeds function can't be used at the same time by default. Because FWD in three gears and High-speed in three speeds use the same pin (FWD, Pin12).
4. The switch signal is valid at 12V.
5. 12V output Pin11 can only be used for switch signals, with a total current not exceeding 40mA.
6. CAN bus is not included in the KLS-N controller by default.
7. Boost and brake analog regen use the same port on Brake_AN(Pin2). When boost is disabled in a user program, Pin2 is used for brake analog regen. When boost is enabled, Pin2 is used for the cost function. Due to port conflicts, these two functions can't operate simultaneously on the same port.

KLS-N Controller Standard Wiring

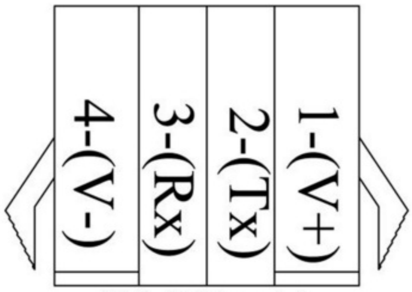


The battery is also used as the controller's power supply.
Caution: Make sure the controller wiring is correct and has been double-checked, especially the B+ and the B- of the controller before powering on. Wiring faults will damage the controller. Ensure that the B- -wiring is securely and properly connected before applying power. The preferred connection of the system contactor or circuit

breaker is in series with the B+ line. Contactors in the B+ line must have a diode across their coils. It was used as a freewheel diode. Lacking this diode may cause serious damage to the power module. Please install this diode as KLS-N controller standard wiring shown above.

Communication Port

A 4-pin connector is provided to communicate with the host for calibration and configuration.



SM-4P(Female)

Installation Check List

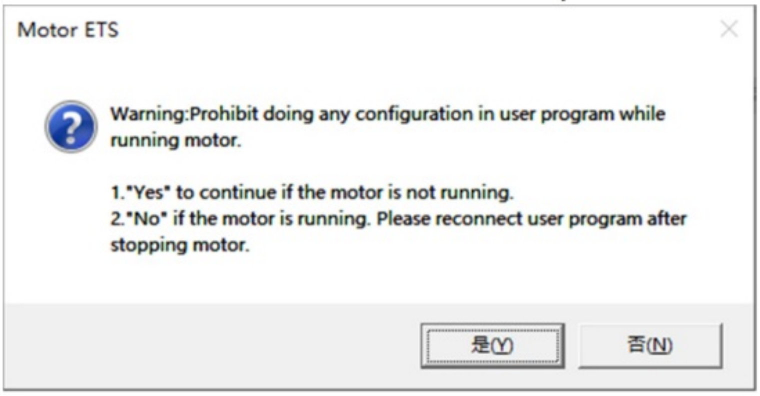
1. Conduct a visual inspection to ensure that components such as mounting holes, wiring, and sealing rings are intact.
2. Check the connection between the battery B+ and NC. For controllers without a fuse, check the connection between the battery B+ and the controller B+ instead of NC.
3. Check the connection between the battery B- and the controller B-.
4. Verify the connections of all signal wires and ensure that their PWR and GND are properly isolated from each other.
5. Check the connection of the motor's Hall wires, the 5V and GND wires should correspond with the motor's interface.
6. Verify the connection of the throttle wires, the 5V and GND wires should correspond with the throttle's interface.
7. Check the connection of the gear wires. It is valid at 12V by default.

Configuration Program

KLS Configuration program allows users to adjust various parameters according to their needs, enabling the motor to achieve optimal performance. The default parameters may not be suitable for all situations. Please ensure that all parameters are adjusted to appropriate values before testing to avoid any potential dangers. Customers can program using either a PC program or an Android app. Before operating the motor, an automatic identification process must be performed. During the process, the controller needs to be connected to the batteries, motor, and throttle. And the PWR(Pin7) needs to be connected with battery B+ to power the controller. Please perform the automatic identification process according to the automatic identification guide.

Notes

1. When configuring existing parameters in the user program or Android app, disconnect the controller from the motor or at least stop the motor.



2. The controller may display fault codes when adjusting parameters, but it will not affect programming or configuration. However, it will affect the auto-identification operation, so please try to eliminate error codes before performing the auto-identification operation.
3. Use the RS232-USB cable and SM-4P adapter provided by Kelly to connect to a host computer. During the operation the PWR of the controller needs to be provided with >+18V (for a 24V controller, provide >+8V). Connect the GND to battery B-.
4. To connect to Android devices, the LS controller requires a Bluetooth adapter.

Connecting to upper host

You have three ways to connect the controller to host computers or Android devices:

1. Using the Kelly USB cable, connect SM-4P (Female) from the controller to the USB port on the computer. You may download the Kelly USB Cable driver or at our website. (**https://media.kellycontroller.com/new/CH341SER.zip**)

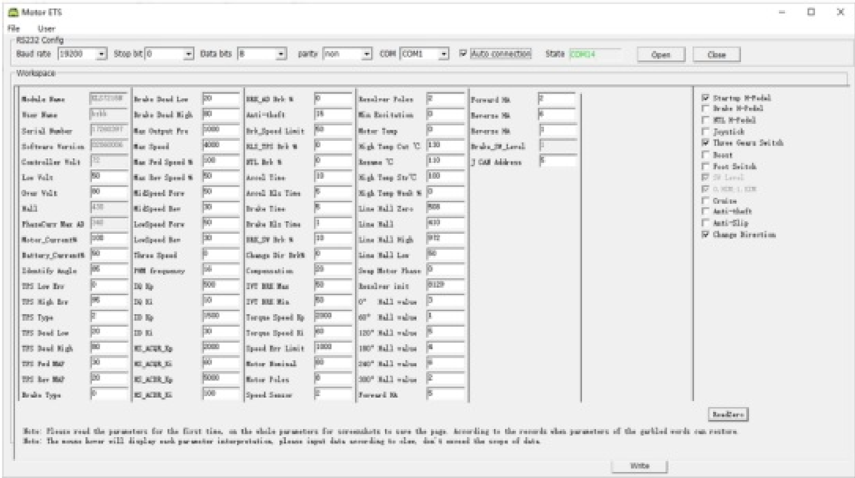
2. Using the RS232-USB cable along with the SM-4Pin adapter, connect SM-4Pin (Female) from the controller to the USB port on the computer. You may download the USB-RS232 driver at our website. (**https://media.kellycontroller.com/new/USB-CONVERTER-RS232-Win10.zip**)


3. Using Bluetooth adapter. Connect it to SM-4P (Female) then connect the controller to Android devices through Bluetooth. This Bluetooth adapter can be purchased from our website.(**https://kellycontroller.com/shop/usb-adapter**)

How to use auto-identification

Here is a brief overview of the automatic identification process:

1. Connect the controller and the motor according to the standard wiring diagram. Please make sure there is no load on the motor shaft before starting the programming.
2. Connect the controller to the PC by using a Kelly USB cable or a USB to RS232 set. For Android devices, please use the Bluetooth adapter to connect the controller.
3. Download the corresponding USB drivers and the user program from our website, only one driver can be installed, two drivers installed at the same time are incompatible. After the USB driver is successfully installed, please restart your PC.
4. Turn the key switch to supply power to the controller from B+/B- and PIN7, then open the user program on your device. Click the ‘READ’ button to open the initial interface as the figure below.



   Please check whether the value of Identification_Angle is at 85. The 85 means this controller had finished the automatic identification operation with the motor in the factory before. It is still needed to run an automatic identification operation before running.

5. Fill 170 in the Identification_Angle value. Then click the write button. The user program will give a pop-up window that shows the Write operation has succeeded. Then exit from the user program and turn off the power supply.
6. Turn on the power supply after the power supply is off for a few seconds. The motor shaft will try to run in random directions. This is a normal operating phenomenon.
7. Wait about 2-3 minutes. The beeper will beep as error code 3-2, meaning the automatic identification operation is finished normally. You will see a reset error message on the monitor screen of the user program.
8. Turn off the power supply again. Then wait about a few seconds to turn on the power supply again.
9. Connect the controller to the user program. You will see 85 in the Identification_Angle. This means, that the controller auto-identification operation has succeeded. The motor is ready to run.
10. If the Identification_Angle value is 170, it means that auto-identification is still in progress.
11. If no error code is triggered, please do not manually write 85 to Identification_Angle or restart the power supply.
12. If a constant beep sound lasts above 5 minutes and there are other error codes such as Identify error, hall error, etc, please return to the initial interface of the user program and write 85 to Identification_Angle manually.
13. Before turning off the power supply, make sure that Identification_Angle is not at 170. Otherwisee the controller will try to keep doing identificatiooperationson all the time after you turn the on power supply again. When the error codes occur, please quit from user program and try step 6 again.
14. After successful identification, make sure that Identification_Angle is not at 170. Then you may turn on the

power supply.

15. If the direction of the motor is not what you expected, there is no need for you to cooperate again, just check the Change Direction option in the last part of the initial interface then click the Write button and reset, and the motor will run in the opposite direction.

Program parameters and value

On the program's initial interface, these items are listed:

Number	Parameter	Possible Value	Default Value	Description	Source of Value*
1	Model Name			Controller Model.	Default
2	User Name			User code, to identify controller variants.	Default
3	Serial Number			Serial Number.	Default
4	Software Version			Software Version.	Default
5	Controller Volt	0-144		Controller Voltage(V).	Default
6	Low Volt	18-180		Minimum normal voltage(V). In order to protect the battery, if the battery voltage is lower than this value, the controller will not work.	User Configuration
7	Over Volt	18-180		Maximum normal voltage(V). In order to protect the battery, if the battery voltage is high1er than this value, the controller will not work.	User Configuration
8	Hall	0-1000		Hall Galvanometer Rate(A).	Default
9	PhaseCurr Max AD	409-2048		The Max AD value of phase current.	Default
10	Motor_Current	20-100%	100%	The ratio range of the motor phase current to the controller peak current.	User Configuration
11	Battery_Current	20-100%	50%	Maximum battery current. Used to set the upper limit of battery current to protect the battery. A lower value will limit the battery output current more and protect the battery more effectively. However, if this value is too low, it will affect acceleration.	User Configuration
12	Identify Angle	85 / 170	85	Status of identification: 85:normal operation. 170: A reboot is required to automatically identify the sensor angle. Once identification is complete, this value will be reset to 85.	Auto
13	TPS Low Err	0-20%	0%	Hall pedal parameter, only valid when TPS type is set to 2. When the actual value is lower than this value, the controller will report a TPS type error, 20%*5V=1V	User Configuration
14	TPS High Err	80-100%	95%	Hall pedal parameter, only valid when TPS type is set to 2. When the actual value is higher than this value, the controller will report a TPS type error, 80%*5V=4V	User Configuration

15	TPS Type	1 / 2	1	Throttle Type, 1: 0-5K,resistance pedal; 2: 0,5V,Hall active pedal;	User Configuration
16	TPS Dead Low	0-60%	20%	Throttle Dead Zone Lower Limit, 20%*5V=1V.	User Configuration
17	TPS Dead High	60-95%	80%	Throttle Dead Zone Higher Limit, 80%*5V=4V.	User Configuration
18	TPS Fwd MAP	0-100%	30%	When moving forward , the MAP value corresponding to throttle midpoint, to adjust throttle response amplitude.	User Configuration
19	TPS Rev MAP	0-100%	20%	When moving backward , the MAP value corresponding to throttle midpoint , to adjust throttle response amplitude.	User Configuration
20	Brake Type	0 / 1 / 2	0	Regen braking mode 0: Switch regen mode. 1:0-5K, resistance pedal regen. 2:0-5V, hall active pedal regen.	User Configuration
21	Brake Dead Low	5-40%	20%	Brake Dead Zone Lower Limit, 20%*5V=1V.	User Configuration
22	Brake Dead High	60-95%	80%	Brake Dead Zone Upper Limit, 80%*5V=4V.	User Configuration
23	Max Output Fre	50-1200	1000	Max output Frequency(Hz).	User Configuration
24	Max Speed	0-16000	4000	Motor max speed (RPM).	User Configuration
25	Max Fwd Speed	0-100%	100%	Maximum forward speed to the motor max speed .	User Configuration
26	Max Rev Speed	0-100%	100%	Maximum reverse speed to the motor max speed.	User Configuration
27	MidSpeed Forw Speed	0-100%	50%	Maximum forward speed in the middle speed gear .	User Configuration
28	MidSpeed Rev Speed	0-100%	30%	Maximum reverse speed in the middle speed gear .	User Configuration
29	LowSpeed Forw Speed	0-100%	50%	Maximum forward speed in the low speed gear .	User Configuration
30	LowSpeed Rev Speed%	0-100%	30%	Maximum reverse speed in the low speed gear .	User Configuration
31	Three Speed	0 / 1 / 2	0	Number of speed modes: 0: one speed mode: maximum speed mode. 1:two speed modes: middle speed mode and maximum speed mode . 2:three speed modes:low speed mode, middle speed mode and maximum speed mode.	User Configuration
32	PWM frequency	10 / 16 / 20	16	PWM modulation frequency (Khz)	User Configuration
33	IQ Kp	0-32767	500	Kp of Q-ring, the proportional gain in Q-ring current loop, is mainly effective at speeds below 400 RPM. Increasing this value will accelerate the response speed but will increase startup jitter; decreasing this value will reduce startup jitter but will also decrease the response speed.	User Configuration
34	IQ Ki	0-32767	10	Ki of Q-ring, the integral gain in Q-ring current loop, is mainly effective at speeds below 400 RPM. Increasing this value will improve current accuracy but will increase startup jitter and instability. Decreasing this value will enhance stability and reduce startup jitter but will also lower current accuracy.	User Configuration
35	ID Kp	0-32767	1500	Kp of D-ring, the proportional gain in D-ring speed loop, is mainly effective at speeds below 400 RPM. Increasing this value will accelerate the response speed but will increase high-speed jitter; decreasing this value will reduce high-speed jitter but will also decrease the response speed.	User Configuration
36	ID Ki	0-32767	30	Ki of D-ring, the integral gain in D-ring current loop, is mainly effective at speeds below 400 RPM. Increasing this value will improve speed accuracy but will increase high-speed jitter and instability. Decreasing this value will enhance stability and reduce high-speed jitter but will also lower speed accuracy.	User Configuration
37	HS_ACQR_Kp	0-32767	2000	Kp of Q-ring, the proportional gain in Q-ring current loop, is mainly effective at speeds above 400 RPM. Increasing this value will accelerate the response speed but will increase startup jitter; decreasing this value will reduce startup jitter but will also decrease the response speed.	User Configuration
38	HS_ACQR_Ki	0-32767	60	Ki of Q-ring, the integral gain in Q-ring current loop, is mainly effective at speeds above 400 RPM. Increasing this value will improve current accuracy but will increase startup jitter and instability. Decreasing this value will enhance stability and reduce startup jitter but will also lower current accuracy.	User Configuration
39	HS_ACDR_Kp	0-32767	5000	Kp of D-ring, the proportional gain in D-ring speed loop, is mainly effective at speeds above 400 RPM. Increasing this value will accelerate the response speed but will increase high-speed jitter; decreasing this value will reduce high-speed jitter but will also decrease the response speed.	User Configuration
40	HS_ACDR_Ki	0-32767	100	Ki of D-ring, the integral gain in D-ring current loop, is mainly effective at speeds above 400 RPM. Increasing this value will improve speed accuracy but will increase high-speed jitter and instability. Decreasing this value will enhance stability and reduce high-speed jitter but will also lower speed accuracy.	User Configuration

41	BRK_AD Brk	0-50%	0%	Brake pedal regen's regen strength, 0= no regen.	User Configuration
42	Anti-theft	0-30%	15%	When the anti-theft function is activated, the percentage of the motor's locking current to the maximum current.	User Configuration
43	Brk_Speed Limit	0-500	0	Minimum motor speed to activate regen brake (RPM), RPM below this value will exit regen.	User Configuration
44	RLS_TPS Brk	0-50%	0%	Pedal releasing regen 's regen strength, 0= no regen.	User Configuration
45	NTL Brk	0-50%	0%	Neutral gear regen 's regen strength, 0= no regen.	User Configuration
46	Accel Time	1-250	5	Torque mode accelerate Time, the time of torque from 0 to max,(X0.1second)	User Configuration
47	Accel Rls Time	1-250	1	Torque mode accelerate release delay Time, the time of torque from max to 0,(X0.1second)	User Configuration
48	Brake Time	1-250	5	Torque mode Brake Time, the time of Brake Torque from 0 to max,(X0.1second)	User Configuration
49	Brake Rls Time	1-250	1	Torque mode Brake release Time, the time of Brake Torque from max to 0,(X0.1second)	User Configuration
50	BRK_SW Brk	0-50%	10%	Switch regen 's regen strength. 0= no Switch regen.	User Configuration
51	Change Dir Brk	0-50%	5%	Change direction regen's regen strength, 0= no Change direction regen.	User Configuration
52	Compensation	0-100%	20%	Compensation current of anti-slip function.	User Configuration
53	IVT BRK Max	0-10000	10000	Maximum motor speed for enable Change direction regen(RPM)	User Configuration
54	IVT BRK Min	0-5000	50	Minimum motor speed for enable Change direction regen (RPM)	User Configuration
55	Torque Speed *Kp*	0-10000	3000	*Kp* of Q-ring **in torque mode**, the proportional gain in Q-ring current loop, is mainly effective at speeds below 400 RPM. Increasing this value will accelerate the response speed but will increase startup jitter; decreasing this value will reduce startup jitter but will also decrease the response speed.	User Configuration
56	Torque Speed *Ki*	0-500	80	Ki of Q-ring **in torque mode** the integral gain in Q-ring current loop, is mainly effective at speeds below 400 RPM. Increasing this value will improve current accuracy but will increase startup jitter and instability. Decreasing this value will enhance stability and reduce startup jitter but will also lower current accuracy.	User Configuration
57	Speed Err Limit	50-4000	1000	Limit of *Kp* and *Ki* in torque mode, need to be adjusted at same time when adjusting *Kp* and *Ki* in torque mode.	User Configuration
58	Motor Nominal	0-1000	80	Motor Current when identification(A)	User Configuration
59	Motor Poles	2-128	8	Number of motor poles, equal to 2* pole pairs. When used for hub motors, reducing this value by multiples, such as from 8 to 4, can improve the speed measurement accuracy.	User Configuration
60	Speed Sensor Type	2 /3/ 4	2	Sensor Type: 2. Hall sensor 3. Magnetic encoder. 4. Linear Hall sensor（sine/cosine sensors）	User Configuration
61	Resolver Poles	2-32		Reserved.	User Configuration
62	Min Excitation	0-100	0	Minimum excitation coefficient (A) This value affects the current and maximum speed of the motor when the field weakening function is enabled. When this value = 0, the field weakening function has no actual effect	User Configuration
63	Motor Temp	0 / 1 / 2	0	Temperature sensor type, 0:none. 1: KTY84-130 and KTY84-150 2: KTY83-122	User Configuration
64	High Temp Cut ℃	60-170	150	Temperature for triggering the motor's high temperature cut off.	User Configuration
65	Resume ℃	60-170	110	When the temperature drops back to this value, high temperature resume will be triggered.	User Configuration
66	High Temp Str℃	0-170	100	starting temperature for high-temperature weakening. (℃)	User Configuration
67	High Temp weak	0-100%	50%	The strength of high-temperature weakening (%)	User Configuration
68	Line Hall Zero	1-1023		Zero point of sine/cosine sensor signal, this value / 1024 * 5 = actual voltage value (Volts). Available for sine/cosine sensor	User Configuration
69	Linear Hall Amplitude	1-1024		Signal amplitude of sine/cosine sensor signal. this value / 1024 * 5 = actual voltage value (Volts). When this value is below 153.6 or above 256,the signal voltage is error. Available for sine/cosine sensor	User Configuration

70	Line Hall High	1-1023		An error will be reported when the amplitude of the sine/cosine sensor signal exceeds this value. this value / 1024 * 5 = actual voltage value (Volts). Available for sine/cosine sensor	User Configuration
71	Line Hall Low	1-1023		An error will be reported when the amplitude of the sine/cosine sensor signal is below this value. this value / 1024 * 5 = actual voltage value (Volts). Available for sine/cosine sensor	User Configuration
72	Swap Motor Phase	0 / 1 /255	0	Swap phase function status 0: disabled 1: enabled, 255: error. Available for sine/cosine sensor	Default
73	Synchro Initial Angle	0-65535	8192	Synchro Initial Angle , defines the reference point of the position when sensor type is set to 4. Available for sine/cosine sensor	Default
74	0° Hall value	0-7	2	Hall sensor sequence value at motor electrical angle 0°.	Auto
75	60° Hall value	0-7	6	Hall sensor sequence value at motor electrical angle 60°	Auto
76	120°Hall value	0-7	4	Hall sensor sequence value at motor electrical angle 120°	Auto
77	180°Hall value	0-7	5	Hall sensor sequence value at motor electrical angle 180°	Auto
78	240°Hall value	0-7	1	Hall sensor sequence value at motor electrical angle 240°	Auto
79	300°Hall value	0-7	3	Hall sensor sequence value at motor electrical angle 300°	Auto
80	Forward HA Rising edge	0-7	6	Forward Hall-A Rising edge sequence value	Auto
81	Forward HA Falling edge	0-7	1	Forward Hall-A Falling edge sequence value	Auto
82	Reverse HA Rising edge	0-7	5	Reverse Hall-A Rising edge sequence value	Auto
83	Reverse HA Falling edge	0-7	2	Reverse Hall-A Falling edge sequence value	Auto
84	Brake_SW_Level	0-255		Brake_SW_Level	Default
85	J CAN Address	0-255	5	CAN Address, when there are multiple CANs, different addresses need to be set	User Configuration
86	Startup H-Pedal	checked/ unchecked	checked	Startup High pedal function , Checked: From powerup, when the first time throttle being pressed, the controller will report a high pedal error to prevent accidental starting, need to step on the pedal again to start.	User Configuration
87	Brake H-Pedal	checked/ unchecked	unchecked	Brake High-pedal function Checked: When press the brake and throttle at the same time, he controller will report a high pedal error to stop running.	User Configuration
88	NTL H-Pedal	checked/ unchecked	unchecked	Neutral High-pedal function Checked: the first time throttle being pressed after switching gears, the controller will report a high pedal error to prevent accidental starting, need to step on the pedal again to start.	User Configuration
89	Joystick	checked/ unchecked	unchecked	Joystick throttle Checked: enable joystick throttle, Its range: 0-2.5V: forward 2.5V: neutral 2.5V-5V: backward. Has same range of dead zone as TPS dead zone.	User Configuration
90	Three Gears Switch	checked/ unchecked	unchecked	Three-gear function Check: Enable three operating gears: Forward, Neutral, Reverse. Uncheck: Forward only.	User Configuration
91	Boost	checked/ unchecked	unchecked	Boost function, Checked: enable boost switch, Connect Brake_AN (PIN2) to 12V to start boost. Unchecked: Connect Brake_AN (PIN2) to 12V to start switch regen.	User Configuration
92	Foot Switch	checked/ unchecked	unchecked	Thorttle switch Checked: Connect Foot_SW to 12V to enable throttle, so motor can start.	User Configuration
93	SW Level	checked/ unchecked	checked	Defining which is the effective level of the switch. Checked: high level=enable. Unchecked: low level=enable.	Default
94	0,HIM;1,KIM	checked/ unchecked	checked	Controller type Checked: KIM. Unchecked: HIM.	Default
95	Cruise	checked/ unchecked	unchecked	Cruise function Check: Enable the cruise function. Press and hold the accelerator for more than 3 seconds to enter the cruise mode. If the eRPM is lower than 4000, the controller will automatically exit the cruise mode.	User Configuration
96	Anti-theft	checked/ unchecked	unchecked	Anti-theft function Checked: enable anti-theft function, Need to connect to external anti-theft device. When the alarm is triggered, the motor will resist being turned.	User Configuration
97	Anti-Slip	checked/ unchecked	unchecked	Anti-Slip function Checked: enable anti-slip function, The motor will resist rotation to prevent the vehicle from moving due to external forces.	User Configuration
98	Change Direction	checked/ unchecked	unchecked	Change Direction function Checked: Swap the forward and backward directions. Unchecked: no swap. Used to correct the motor from moving opposite direction after identification	User Configuration

Source of Value

1. **User:** Users should modify these values to adjust the controller.
2. **Auto:** These values are generated by the sensor or the controller's program, and users can affect the operation of the controller by modifying these values.
3. **Default:** These values are factory presets or sensor readings that cannot be modified by the user program.

Maintenance

Caution:
There are no user-serviceable parts inside the controller. Do not attempt to open the controller on your own, as this will void your warranty. The exterior of the controller should be cleaned periodically. The controller is a high-powered device. When working with any battery-powered vehicle, proper safety precautions should be taken that include, but are not limited to proper training, wearing eye protection, avoidance of loose clothing, hair, and jewelry, and iusinginsulated tools.
Although the controller virtually requires no maintenance after proper installation, it is recommended to follow these steps during use:

1. Disconnect the battery, starting with the positive terminal, to cut off the power.
2. Discharge the capacitors in the controller by connecting a load (such as a contactor coil, resistor, or horn) across the controller's B+ and B- terminals.
3. Regularly remove any dirt or corrosion from the bus bar area. Wipe the controller with a moist rag and ensure it is completely dry before reconnecting the battery.
4. Make sure the connections to the bus bars are tight. To avoid physically stressing the bus bars, use two well-insulated wrenches for the operation.
5. Fanned models require routine fan maintenance, including ensuring the fan rotates normally and cleaning the dust on the fan.

Error Codes

Buzzer Error Codes

Error code			Explanation	Solution
1, 1	□	□	Auto-Identification failed	1. Check Phase line or Hall line. 2. Check Hall power line(+5V and GND). 3. The motor load maybe too high. Please unload the motor before proceeding with identification.
1, 2	□	□□	Over voltage error	1. Battery voltage is too high for the controller. Check battery volts and controller configuration. 2. Regeneration over-voltage. Controller will limit regen or stop regen. please reduce the regen ratio in configuration.
1, 3	□	□□□	Low voltage error	Battery voltage is too low, please check the battery and recharge. When the battery voltage continuously exceeds the low voltage cut-off value for 5 seconds, the controller will resume normal operation.
1, 4	□	□□□□	The controller did not receive CAN commands	Resend CAN commands from VCU.
2, 1	□□	□	Motor stall	The motor did not reach 25eRPM within 2 seconds of starting. Please check the Hall signal lines and the phase line connections.
2, 2	□□	□□	Internal voltage error	1. Check the connection between PWR and B+(For 8080N series, check connection between PWR and +12V; GND and -12V). 2. The load on the 5V or 12V power supply could be too heavy, ensure that the measured voltage of the 5V power supply is not less than 4V and the voltage of the 12V power supply is not less than 8V. The lower these values are, the heavier the load on the power supply. 3. If none of the above issues are present, the internal power module of the controller may be damaged. The controller needs to be sent back to the factory.
2, 3	□□	□□□	Over temperature	The controller temperature is too high, about to stop. Please wait until it restore to 80℃.
2, 4	□□	□□□□	Throttle error at power on	Throttle signal is higher than the value of "TPS_dead_low"at power-on. Release the throttle and press again or adjust the TPS_dead_low value. If still can't fix the issue, check if the throttle is functioning properly.
3, 1	□□□	□	Reserved	
3, 2	□□□	□□	Internal reset error	Current is too high or current fluctuations are too large. Reduce the phase current and check if the 5V and 12V power supplies are normal.
3, 3	□□□	□□□	Hall throttle is open or short-circuit	May occur after TPS_Type being set to 2. 1. The throttle might have an internal short circuit or the ground wire might be disconnected. 2. Set TPS_High_Err to 95 , check the throttle and its wiring, then restart to fix the issue.
3, 4	□□□	□□□□	Angle sensor error	1. Speed sensor type error,customers may set the correct sensor type through user program or App. 2. Incorrect wiring. 3. Speed sensor is damaged or defective. Or feedback signal is erratic.
4, 1	□□□□	□	Switch-direction error	1. Throttle is not at 0 when switching motor direction. 2. Motor rotation speed is above 50RPM.
4, 2	□□□□	□□	Reserved	
4, 3	□□□□	□□□	Motor over-temperature	May occur after motor temp being set to 1 or 2. The Motor temperature has exceeded the configured maximum value. The controller will shut down until the motor temperature cools down.
4, 4	□□□□	□□□□	Hall Galvanometer sensor error	Hall galvanometer inside the controller is damaged.
Error codes can be read through PC software or Android app.				

Contact Us
Home Page: http://www.KellyController.com
DDownload the user manual, instructions, and user program: https://kellycontroller.com/support/
E-mail: Sales@Kelly-Controls.com
Phone: (01) 224 637 5092

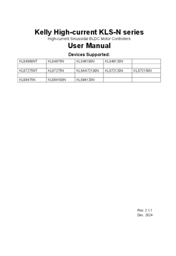
FAQs

Q: Can the KLS-N motor controller be used with sensorless brushless motors?
A: No, the KLS-N motor controller must be used with Hall sensors and currently does not support sensorless brushless motors.

Q: What caution should be taken before running the motor with the controller?
A: Before running the motor, start the auto-identification operation first. Do not attempt to connect the controller to

the user program or change settings while the motor is running.

Documents / Resources

 Kelly High-current KLS-N series User Manual Devices Supported	**Kelly KLS-N Series High Current Sinusoidal BLDC Motor Controllers** [pdf] User Manual KLS-N Series High Current Sinusoidal BLDC Motor Controllers, KLS-N Series, High Current Sinusoidal BLDC Motor Controllers, Sinusoidal BLDC Motor Controllers, BLDC Motor Controllers, Motor Controllers, Controllers

References

- **Kelly Controls - Motor Controllers, EV Parts**
- **USB and bluetooth Adapter between controllers and PC or Android Devices - Kelly Controls**
- **User Manual**