Fourth Generation 2 x 30A or 1 x 60A Brushless DC Motor Controller

CANopen

Roboteq's SBLG23xx is a features-packed, high-current, dual or single channel controller for brushless DC motors.It is a direct replacement for the company's popular SBL23xx, using a 4th generation processor and implementing many performance, algorithmic, and other qualitative enhancements. The controller can be commanded via serial, USB, Analog or Pulse signals. Multiple controllers can be networked over a low-cost, twisted pair CANbus network.

The SBLG23xx uses the latest motion control technology, such as field-oriented control (FOC), acceleration/velocity Feedforward, and fast loop frequency to deliver quick and precise motion control in speed, torque or postilion modes. Numerous safety features, including Safe Torque Off (STO) are incorporated into the controller to ensure reliable and safe operation. For mobile robot applications, the controller's two motor channels can either be operated independently or mixed to move and steer a vehicle.

The controller's operation can be extensively automated and customized using Basic Language scripts. The controller can be configured, monitored and tuned in real-time using a Roboteq's free PC utility. The controller can also be reprogrammed in the field with the latest features by downloading new operating software from Roboteq.

Applications

- Automatic Guided Vehicles
- Small Electric Vehicles, Electric Bikes
- Terrestrial and Underwater Robotic Vehicles
- Police and Military Robots
- Hazardous Material Handling Robots
- Balancing Robots
- Telepresence Systems
- Animatronics

Key Features

- USB, Serial, 0-5V Analog, or Pulse (RC radio) command modes
- One RS232 serial ports
- MODBUS ASCII & RTU Support over RS232 or RS485 (RS485 is available by special order).
- CAN bus up to 1 Mbit/s. Multi-Protocol support
  - CANOpen DS402
  - RoboCAN Meshed Network
  - RawCAN Customizable to Any Protocol
- Auto switch between Serial, USB, CAN, Analog, or Pulse based on user-defined priority
- Built-in dual 3-phase high-power drivers for two brushless DC motors
- 2x30A Max, 2x16A continuous Current with I2T protection algorithm
- Output channels can be paralleled in order to drive a single motor at up to 60A (Requires special firmware)
- Programmable current limit up to 30A (60A on single channel version) per motor for protecting controller, motor, wiring and battery.
- Supports Surface Permanent Magnet (SPM) motors or Internal Permanent Magnet (IPM) motors
- 97% or better typical Efficiency
- Multiple Motor Operating mode
  - Trapezoidal with Hall Sensors
  - Sinusoidal with Hall+Encoder
  - Sinusoidal with Encoders
  - Sinusoidal with Hall Sensors
  - Sinusoidal with Absolute Encoder
- Support for absolute angle encoders
  - Sin/Cos analog
  - SSI (single-turn and multi-turn)

- Field Oriented Control in Sinusoidal modes
- Automatic Field Weakening for maximizing motor speed and torque
- Full forward & reverse motor control. Four quadrant operation. Supports regeneration
- Operates from a single 10V-60V power source
- STO - Safe Torque Off (Certification Pending)
- Separate connector for Hall Sensors
- Accurate speed and Odometry measurement using Hall Sensor or Encoder data
- Up to 8 Analog Inputs for use as command and/or feedback
- Up to 8 Pulse Length, Duty Cycle or Frequency Inputs for use as command and/or feedback
- Up to 10 Digital Inputs for use as Deadman Switch, Limit Switch, Emergency stop or user inputs
- Inputs for up to 2 Quadrature Encoders
- 4 general purpose 24V, 1.5A open collector outputs for brake release or accessories
- Built-in Basic-like scripting language. Execution speed up to 100000 lines per second
- Selectable min, max, center and dead band in Pulse and Analog modes
- Selectable exponentiation factors for each command inputs
- Trigger action if Analog, Pulse or Hall counter capture are outside user selectable range (soft limit switches)
- Open loop speed control operation
- Closed loop speed, position and/or torque control
- Closed loop position control with encoder, hall sensors, analog or pulse/frequency feedback
- Cascaded Speed, Position, Torque PID loops
- High-Performance 16kHz Current Control loop
- Automatic Tuning of Torque, Speed and Position loops
- Automatic Motor Characterization
- Advanced performance optimization algorithms (Anti-cogging, notch filter, Decoupling control, ...)
- Support for NTC temperature sensors through analog inputs (requires an external pull-up resistor)
- Built-in Battery Voltage and Temperature sensors
- Optional backup power input for powering safely the controller if the main motor batteries are discharged
- Power Control wire for turning On or Off the controller from external microcomputer or switch
- Regulated 5V output for powering RC radio, RF Modem, sensors or microcomputer
- Separate Programmable acceleration and deceleration for each motor
- Ultra-efficient 3.3 mOhm ON resistance MOSFETs (1.65 mOhm on Single Channel) for SBLG2360
- Stall detection and selectable triggered action if Amps is outside user-selected range
- Short circuit protection
- Overvoltage and Undervoltage protection
- Watchdog for automatic motor shutdown in case of command loss
- Overtemperature protection
- Diagnostic LED
- Efficient heat sinking. Operates without a fan in most applications.
- Dustproof and weather resistant. IP40 rating
- Power wiring using screw terminals
- 4.8" (123.0mm) L, 3.3" W (83.0mm), 1.0" (25mm) H
- -10° to +70° C operating environment
- Weight: 0.47 lbs (215g)
- Easy configuration, tuning and monitory using provided PC utility
- Field upgradeable software for installing latest features via the internet Orderable Product References

Orderable Product References

Reference	Number of Channels	Amps/Channel	Volts	STO
SBLG2360T	2	30	60	Yes
SBLG2360TS	1	60	60	Yes

Warning

A dangerous uncontrolled motor runaway condition can occur due to various reasons, including, but not limited to: command or feedback wiring failure, configuration errors, faulty firmware, errors in user scripts or programs, or controller hardware failure.

Users must be aware that such failures can occur and must ensure the safety of their system under all conditions. Roboteq will not be held liable for any damage or injury resulting from product misuse or failure.

Important Note

All products are not serviceable. If damage is suspected, the item must be replaced rather than repaired.

Attempting to service or repair the product voids any existing warranty and may pose safety risks.

Consult customer support for more information on replacements.

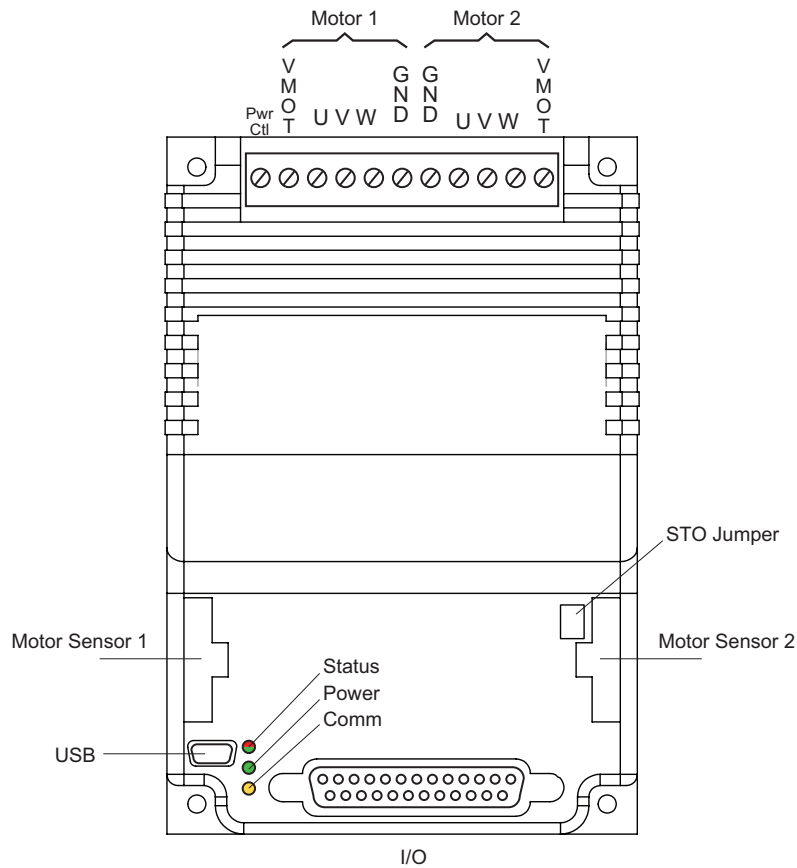


FIGURE 1. SBLG23xx Outline

Figure 2, below, shows how to wire the controller in a dual motor configuration, and how to turn power On and Off.

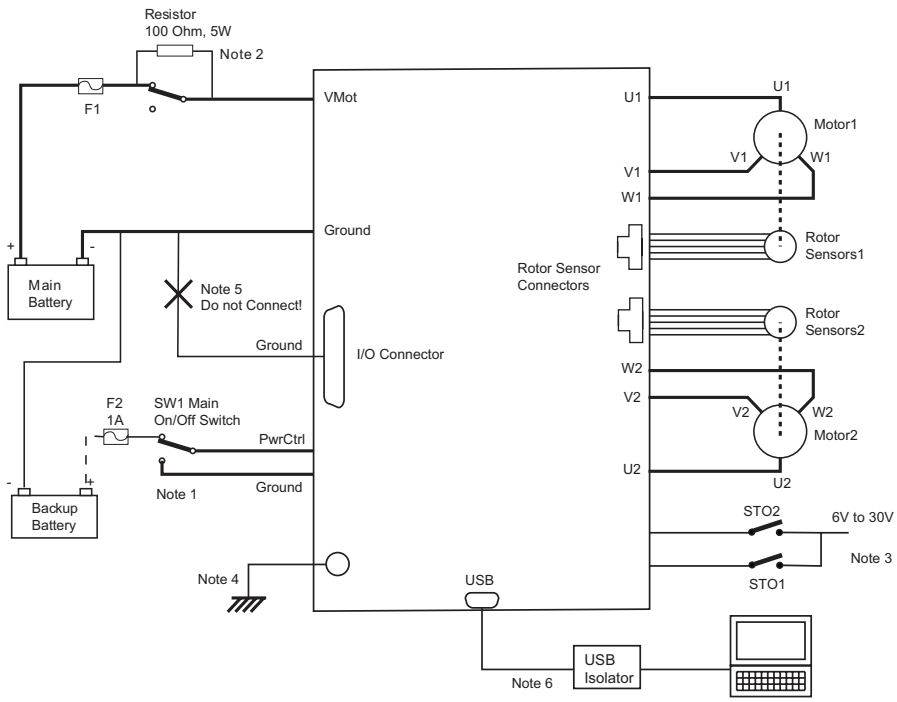


FIGURE 2. Powering the Controller. Thick lines identify MANDATORY connections

Caution

Carefully follow the wiring instructions provided in the Power Connection section of the Roboteq Controllers User Manual. The information on this datasheet is only a summary.

Mandatory Connections

It is imperative that the controller is connected as shown Figure 2 in order to ensure a safe and trouble-free operation. All connections shown as thick black lines line are mandatory.

Emergency Switch or Contactor

The battery must be connected Permanently to the controller's VMot tab via a high-power emergency switch or contactor SW2. The user must be able to deactivate the switch or contactor at any time, independently of the controller state. SW2 should be used only in emergency situations and not for normal operation. Opening SW2 while the motors are rotating can lead to permanent hardware damage. Use a suitable high-current fuse F1.

Power On/Off Switch

The controller must be powered On/Off using switch SW1 on the Power Control pin.

Note 1: To ensure motor operation with weak or discharged batteries, connect a second battery to the Power Control pin via the SW1 switch. This will keep the controller alive and responding even if no voltage is present on the VMot terminal.

Precharge Resistor

The controller has internal capacitance which will cause a brief yet significant current inrush the moment power is applied.

Note 2: If there is a concern that this current can overload the power supply, fuse and/r the contactor, insert a precharge resistors as shown in figure 2. For precharging to take place, the controller must be turned off by grounding the Power Control pin.

Enable Safe Torque Off

Note 3: When the STO jumper is off, STO is enabled and the motor will be prevented from running until both of its STO inputs are connected to a voltage of 6V or higher. If one or both STO lines are left floating or grounded, the drive will be ON and able to communicate, but the motor will not be driven. For more details, refer to the STO chapter further down in this document and consult the Roboteq Controllers User Manual.

Connection to Chassis

Note 4: For improved EMI immunity and reduced emissions, it is recommended to connect the controller's bottom plate to the system's chassis. Note that the integrated controller's ground is not DC-electrically connected to the plate. However, there is a capacitor between the controller's ground and the bottom plate, providing AC conductivity.

Avoid Alternate Ground Paths

Note 5: Be cautious not to create a path between the ground pins on the I/O connector and the battery's negative terminal. An internal connection already exists between the battery's negative pole and the control ground. Avoiding an additional external connection is highly recommended, as this could allow current to circulate in the signal ground, potentially introducing noise into low-power signals. If the main power ground terminal becomes loose or disconnected, very high current from the motor may flow through the signal ground wire, causing damage.

Electrostatic Discharge Protection

In accordance with IEC 61000-6-4, Roboteq Motor Controllers are designed to withstand ESD up to 4kV touch and 8kV air gap. This protection is implemented without any additional external connections required.

Some specifications, such as EN12895, require a higher level of protection. To maximize ESD protection, up to 8kV touch and 15kV air gap, connect the metallic heatsink of the controller to the battery's negative terminal.

Precautions When Connecting PC via USB

Note 6: Always use a USB isolator to protect both the drive and the PC against potential electrical damage. When using a portable PC, operate it on battery power to avoid creating an accidental return ground path via the charger.

Controller Mounting

The drive should be mounted in such a way that its bottom surface makes direct contact with a metallic surface, such as the system chassis or cabinet. This will assist in dissipating the heat generated during the operation of the controller. It's important to note that the nominal and peak ampere values documented in the datasheet can only be fully achieved with adequate cooling.

Single Channel Wiring

On the Single Channel SBLG23XXS, each of the motor wires must be connected to both output tabs labeled with the same letter, as shown in figure 3. The sensors connected to Channel One will be used for the motor's operation.

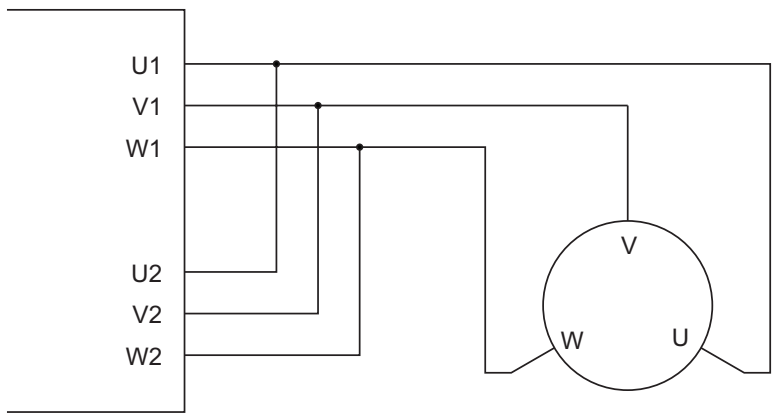


FIGURE 3. Single Channel wiring diagram

Caution

This wiring must be done only on the single channel version of the controller. Paralleling the wires on a dual channel product will cause permanent damage. Verify that your controller is an SBLG2360S before you wire in this manner.

Hall Sensors Connection

Connection to the Hall Sensors is done using a 6-pin Molex Microfit 3.0, ref. 43645-0600. Pin assignment is in table 1.

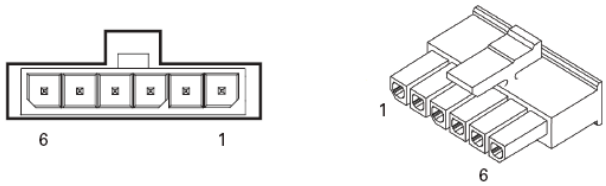


FIGURE 4. Hall Sensors Connector

TABLE 1.

Pin Number	1	2	3	4	5	6
Signal	Ground	Hall A	Hall B	Hall C		5V

Connection to SSI Absolute Encoder

Both multi-turn and single-turn SSI sensors are supported in sinusoidal mode, with pure binary encoding (no Gray code, offset binary, etc.) and a resolution of up to 48 bits. These SSI sensors must be connected to the 6-pin Molex connectors, which are also used for Hall sensors. The specific sensor connected to the Molex connectors can be determined through the controller's configuration settings. The controller employs differential signals for both clock and data. The Molex connector pin assignment for the SSI sensor is shown in Table 2.

TABLE 2.

Pin Number	1	2	3	4	5	6
Signal	Ground	Data +	Data –	Clock +	Clock –	5V

Connection to Analog Sin/Cos Absolute Encoder

The SBLG23xx features four high-speed analog inputs, designed to capture the absolute angular position data from magnetic sensors that have sin/cos voltage outputs. For the sin/cos sensors, the signal must range from 0 to 5V, with 0 at 2.500V. The table 3 shows the signals assignment on the 25-pin connector. The sensor can be single ended or differential.

TABLE 3. Differential Sin/Cos signals on the SBLM23xxx

Pin Number	1	2	3	4	5	6
Signal	Ground	Sin +	Sin –	Cos +	Cos –	5V

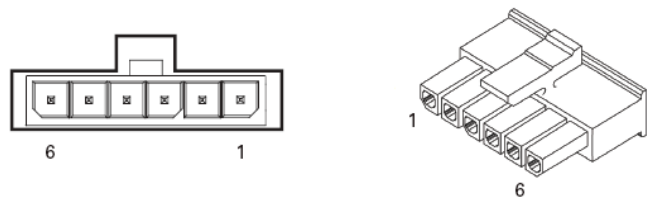


FIGURE 5. Motor sensor connector pin identification

Commands and I/O Connections

Connection to external devices, such as RC radios, microprocessors, joysticks, sensors, and low current actuators, is done through the DB25 connector. The controller is equipped with general-purpose inputs that can be configured to function as digital, analog, or pulse inputs. Additionally, it features open collector outputs capable of driving resistive or inductive loads of up to 1 A. The pin assignment can be found on table 4.

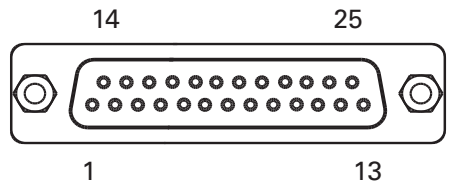


FIGURE 6. Main Connector Pin Locations

TABLE 4.

Connector Pin	Power	Dout	Com	Pulse	Ana	Dinput	STO	Enc
1	GND							
14	5VOut							
2			RS TxD					
15				RC1	ANA1	DIN1		
3			RS RxD					
16				RC2	ANA2	DIN2		
4				RC3 (2)	ANA3	DIN3	STO1 (1)	
17				RC4 (2)	ANA4	DIN4	STO2 (1)	
5	GND							
18		DOUT1						
6		DOUT2						
19		DOUT3						
7		DOUT4						
20			CANH					
8			CANL					
21				RC5 (3)	ANA5	DIN5		ENC2A
9						DIN9		
22				RC6 (3)	ANA6	DIN6		ENC2B
10						DIN10		
23			RS485+					
11			RS485–					
24				RC7	ANA7	DIN7		ENC1A
12				RC8	ANA8	DIN8		ENC1B
25	5VOut							
13	GND							

Note 1: STO jumper must be removed for STO signals to be active.
Note 2: Not compatible with MultiPWM inputs
Note 3: Not compatible with multiPWM when SSI sensor is used.

Enabling Analog Commands

The Analog command mode is disabled by default. To enable this mode, use the PC utility and set "Analog" in Command Priority 2 or 3 (leave "Serial" as priority 1). Note that by default, additional safety features are enabled, preventing the motor from starting unless the potentiometer is centered, or if the voltage is below 0.25V or above 4.75V.Use the PC utility to enable and assign analog inputs.

Connecting Thermistors

NTC temperature sensors can be connected to the controller's analog inputs. This enables reading of motor temperature through the controller's runtime variables and allows for active temperature protection. This connection can be achieved by using a pull-up resistor with a value equal to the thermistor's resistance between the analog input and the controller's 5V output. For more information about motor temperature readings and controller parameterization, please refer to the Roboteq Controller's User Manual.

USB communication

Use the USB only for configuration, monitoring, and troubleshooting purposes. USB is not a reliable method of communication and can lead to disconnections when used in electrically noisy environments. These disconnections often require resetting the USB connection or even the controller. For more reliable interfacing with a computer, always opt for RS232 communication. USB and CAN can operate at the same time on the SBLG2360. Plugging USB to a computer will not disable CAN interface.

Important Note

Always use a USB isolator to protect both the drive and the PC from potential electrical damage. When using a portable PC, operate it on battery power to avoid an accidental ground path return via the charger.

CAN Communication

CAN is the SBLG23xx's primary and recommended communication interface. Up to 127 drives can be networked on a twisted pair network up to 1000m long and at speeds up to 1Mbit/s. Roboteq support four CAN protocols:

- CANOpen for interoperability with other vendor's DS301 and DS402 compliant devices
- RoboCAN, a simple and effective peer to peer meshed network protocol
- MiniCAN, a simplified subset of CANOpen PDOs
- Raw CAN, a low-level system used with scripting for constructing and parsing CAN frames to handle any protocols

TABLE 5. CANOpen Communications Specification

Feature	Value
Motion Network type	CAN, CANOpen
CANOpen Standards Support	DS301, DS402
Operating Modes	Cyclic sync torque, cyclic sync velocity, cyclic sync position, profile position, profile velocity, profile torque modes, homing
Process Data Objects (PDO)	Cyclic sync and free run modes. Cyclic messages can be set for 20 objects on 4 maps

RS485 Communication

RS485 is a robust industry standard for serial communication, well-suited for long distances and electrically noisy industrial settings. It uses balanced signaling for enhanced stability, allowing the connection of multiple receivers on a single network. The protocol supports half-duplex operation and is particularly compatible with Modbus. The 25-pin connector features designated pins for RS485+ and RS485-.

Please note that RS485 support is optional and available in selected models.

Important Note

In some models, RS485 communication requires two 10 kΩ resistors to be connected to the A and B signals of the bus as follows:

- **One resistor should be connected from the A signal to the controller's 5V output.**
- **One resistor should be connected from the B signal to the controller's ground.**

Status LEDs and Flashing Patterns

The controller is equipped with three LEDs. A Green Power LED, a Red/Green Status LED, and a Yellow Communication LED. After the controller is powered on, the Power LED will tun on, indicating that the controller is On. The Status LED will be flashing at a two second interval. The flashing pattern and colour provides operating or exception status information.

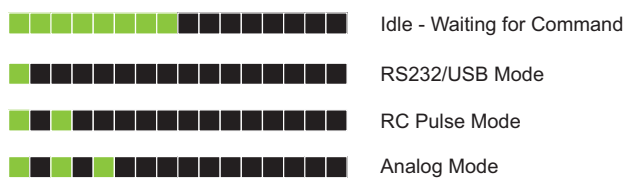


FIGURE 7. Normal Operation Flashing Patterns

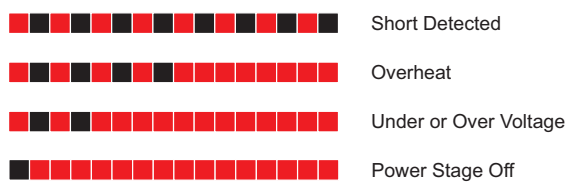


FIGURE 8. Exception or Fault Flashing Patterns

Additional information about the controller's status and fault conditions can be obtained by monitoring the controller through the PC utility. The Communication LED indicates the status of USB and CAN Bus connectivity.

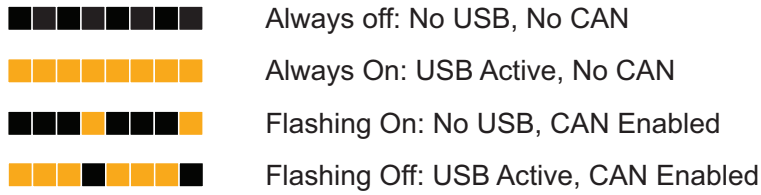


FIGURE 9. Communication LED Flashing Patterns

Measured Amps

The controller is equipped with current sensors aligned with both the motor and battery ground terminals, ensuring precise measurements of both motor and battery amperes.

When the motor is rotating, the amperes are AC. The SBLG23xx measures and is rated based on RMS (Root Mean Square) amperes. Table 6 illustrates the relationship between RMS current and its DC equivalent in both Sinusoidal and Trapezoidal modes. In Sinusoidal mode, the DC equivalent comprises the amperes resulting from the torque (Iq) and quadrature (Id) vectors. In Trapezoidal mode, the DC equivalent represents the amperes flowing through the two active coils at any given time.

TABLE 6.

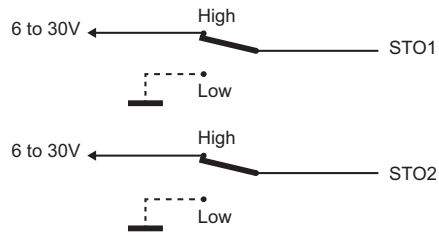
	Amps RMS	DC Equivalent
Sinusoidal	30A	42.4A (Irms * 1.414)
	16A	22.6A (Irms * 1.414)
Trapezoidal	30A	36.8A (Irms * 1.225)
	16A	19.6A (Irms * 1.225)

Safe Torque Off - STO

Safe Torque Off (STO) is a secure method for switching the controller into a state where no torque is generated, regardless of whether the controller is operating normally or is faulty. The STO functionality is achieved through redundant circuitry, incorporated into the STO1 and STO2 inputs of the controller. For the controller to operate normally, both STO inputs must be supplied with a voltage ranging from 6 to 30V. The controller performs a self-test of the STO circuitry every time it powers on, or when both STO inputs go high. If the STO circuitry is found to be functioning properly, the controller will allow the motor to be energized. In the event of an STO failure or if not both STO inputs are in a high state, the power stage will be cut off. Since STO is a hardware implementation and has been verified and validated by Roboteq, it can be trusted to bring the motor to a no-torque condition without the need for an external relay to cut power to the motor. For more information about STO functionality, refer to the STO Manual.

By factory default, the STO functionality is disabled by adding a jumper that bypasses the STO circuitry. To enable the STO feature, remove the jumper located on the front side of the controller and then enable the STO function in the controller's configurations. The exact location of the jumper can be observed in figure 1.

Figure 10 illustrates the STO operation. To properly trigger the STO, both STO inputs must be in a high state. To properly release the STO, both STO inputs must be low. Having only one of the two STO inputs in a high state will trigger the "STO fault" alarm.



STO1	STO2	Motors Output
Low	Low	Disabled
High	Low	Disabled/Fault
Low	High	Disabled/Fault
High	High	Enabled

FIGURE 10. STO input levels effects on controller output

Warning

Activating STO causes the motor to float and cease torque generation. Since the motor will not be actively braked, it will decelerate solely due to the system's friction. In mobile robot applications, the robot may continue moving for several meters before coming to a complete stop. For safe operation, additional braking measures should be implemented when STO is enabled, such as utilizing a mechanical or electrical brake. Roboteq offers one solution in the form of the SBSxxxx Safety Electric Brake Switch series, which quickly stops the motor by shorting its phases when STO is triggered.

Electrical Specifications

Absolute Maximum Values

The values in Table 7 should never be exceeded, as doing so may result in permanent damage to the controller.

TABLE 7.

Parameter	Measure point	Min	Typ	Max	Units
Battery Leads Voltage	Ground to VBat			63 (1)	Volts
Reverse Voltage on Battery Leads	Ground to VBat	–1			Volts
Power Control Voltage	Ground to Pwr Control wire			63 (1)	Volts
Motor Leads Voltage	Ground to U, V, W wires			63 (1)	Volts
Digital Output Voltage	Ground to Output pins			30	Volts
Analog and Digital Inputs Voltage	Ground to any signal pin on 15-pin & Encoder inputs			30	Volts
Hall inputs voltage	Ground to Hall inputs of Molex connector			5.5	Volts
RS232 I/O pins Voltage	External voltage applied to Rx pin			30 (2)	Volts
Note 1: Maximum motor voltage including regeneration. Never inject a DC voltage from a battery or other fixed source Note 2: No voltage must be applied on Tx pin					

Power Stage Electrical Specifications (at 25ºC ambient)

TABLE 8.

Parameter	Measure point	Model	Min	Typ	Max	Units
Input Continuous current	Power source current	All			40	Amps
Output Voltage	Ground to U, V, W wires	All	0 (1)		60 (2)	Volts
Power Control Voltage	Ground to Power Control wire	All	0 (1)		60	Volts
Minimum Operating Voltage	VBat or Pwr Ctrl wires	All	10 (3)			Volts
Over Voltage protection range	Ground to VMot	All	5	60 (4)	60	Volts
Under Voltage protection range	Ground to VMot	All	0	5 (4)	50	Volts
Input Capacitance	Ground to VMot	All		2350		uF
Idle Current Consumption	VMot or Pwr Ctrl wires	All	50	100 (5)	150	mA
ON Resistance (Excluding wire resistance)	VMot to U, V or W. Ground to U, V or W	SBLG23xx		3.3		mOhm
		SBLG23xxS		1.65		mOhm
Max Current for 30s	Motor current	SBLG23xx			30	Amps
		SBLG23xxS			60	Amps
Continuous Max Current per channel	Motor current	SBLG23xx			16 (6)	Amps
		SBLG23xxS			32 (6)	Amps
Current Limit range	Motor current	SBLG23xx	10	30	30	Amps
		SBLG23xxS	20	60	60	Amps
Stall Detection Amps range	Motor current	SBLG23xx	10	30 (7)	30	Amps
		SBLG23xxS	20	60 (7)	60	Amps
Stall Detection timeout range	Motor current	All	1	500 (8)	65000	msec
Short Circuit Detection threshold (9)	Between Motor wires or Between Motor wires and ground or Between Motor wires and Vmot	SBLG23xx			78 (10)	Amps
		SBLG23xxS			186 (10)	Amps
Power cable thickness	Power input and output	All		14		AWG

Note 1: Negative voltage will cause a large surge current. Protection fuse needed if battery polarity inversion is possible

Note 2: Can be even higher because of regeneration voltage. Never inject a DC voltage from a battery or other fixed source

Note 3: Minimum voltage must be present on VBat or Power Control wire

Note 4: Factory default value. Adjustable in 0.1V increments

Note 5: Current consumption is lower when higher voltage is applied to the controller's VBat or PwrCtrl wires

Note 6: Estimate. Limited by case temperature. Current may be higher with better cooling

Note 7: Factory default value. Adjustable in 0.1A increments

Note 8: Factory default value. Time in ms that Stall current must be exceeded for detection

Note 9: Controller will stop until idle command given in case of short circuit detection

Note 10: Approximate value

Command, I/O and Sensor Signals Specifications

TABLE 9.

Parameter	Measure point	Min	Typ	Max	Units
Main 5V Output Voltage	Ground to 5V pins on	4.6	4.75	4.9	Volts
5V Output Current	5V pins on Molex and DSub25			150 (1)	mA
Digital Output Voltage	Ground to Output pins			30 (2)	Volts
Output On resistance	Output pin to ground		0.25	0.5	Ohm
Output Short circuit threshold	Output pin	1.7		3.5	Amps
Digital Output Current	Output pins, sink current			1.5(2)	Amps
Input Impedances (except DIN7-8)	AIN/DIN Input to Ground		53		kOhm
Digital Input 0 Level	Ground to Input pins	–1		1	Volts
Digital Input 1 Level	Ground to Input pins	3.8		30	Volts
Analog Input Range	Ground to Input pins	0		5.1	Volts
Analog Input Precision	Ground to Input pins		0.5		%
Analog Input Resolution	Ground to Input pins		1		mV
Pulse durations	Pulse inputs	20000		10	us
Pulse repeat rate	Pulse inputs	50		250	Hz
Pulse Capture Resolution	Pulse inputs		1		us
Minimum Pulse on or Pulse off duration	Pulse inputs	25			us
Frequency Capture	Pulse inputs	100		2000	Hz
Encoder Frequency	Encoder input pins			200	kHz
SSI Frequency	SSI input pins	680		10800	kHz
Note 1: Sum of all 5VOut outputs Note 2: Outputs are Open Drain. They pull to ground when on and float when off. Load must be connected between output and positive voltage					

Operating & Timing Specifications

TABLE 10.

Parameter	Measure Point	Min	Typ	Max	Units
Command Latency	Command to output change	0	0.5	1	ms
Maximum PWM duty cycle	Motor Output			94	%
Closed Loop update rate	Internal		1000		Hz
RS232 baud rate	Rx & Tx pins		115200 (1)		Bits/s
RS232 Watchdog timeout	Rx pin	1 (2)		65000	ms
Note 1: 115200, 8-bit, no parity, 1 stop bit, no flow control Note 2: May be disabled with value 0					

Motor Characteristics Requirement for FOC current control

For proper FOC current control and motor operation under sinusoidal commutation, it is necessary for the motor to meet a minimum load inductance, minimum time constant (L/R) and maximum electric operating speed requirements. The minimum required inductance is necessary to ensure low Total Harmonic Distortion (THD) of the motor current. Furthermore, to achieve proper current control and stability, the controller's current loop sampling rate will determine the minimum permissible motor time constant and the maximum operating electric speed.

TABLE 11.

Parameter	Input DC Voltage (V)	Value	Units
Minimum load phase inductance (1)	24	40	uH
	48	60	uH
	60	80	uH
Minimum load inductance/resistance ratio (1)	0 - 60	0.063	msec
Maximum operating electric speed (2)	0 - 60	96000	RPM
Note 1: Star connected three phase load considered. In case the motor phase inductance does not fulfill the above requirements (minimum phase inductance and inductance/resistance ratio) an external AC inductor with proper inductance value is recommended to be added. Note 2: Maximum rotor speed is calculated from the maximum operating electric speed and pole pairs. For example, in a motor with 4 pole pairs the maximum operating rotor speed is 96000/4 = 24000 rpm			

Scripting

TABLE 12.

Parameter	Measure Point	Min	Typ	Max	Units
Scripting Flash Memory	Internal		32000		Bytes
Integer Variables	Internal		4096		Words (1)
Boolean Variables	Internal		8192		Symbols
Execution Speed (2)	Internal	30,000		70,000	Lines/s
Note 1: 32-bit words Note 2: Execution Speed was calculated based on low communication load with the controller. In high communication workload, minimum time might be reduced drastically.					

Thermal and Environmental Specifications

TABLE 13.

Parameter	Measure Point	Min	Typ	Max	Units
Heatsink Temperature	External heatsink			75 (1)	°C
Thermal Protection range	PCB	0		90 (2)	°C
Power Dissipation	Case			10	Watts
Thermal resistance	Power MOSFETs to plate			0.8	°C/W
Humidity	Case			93 (6)	%
Ambient temperature	Ambient	-10		70	°C

TABLE 13.

Parameter	Measure Point	Min	Typ	Max	Units
Storage temperature	Ambient	-20		80	ºC
Pollution Degree	-	PD 2			
Fast fuse to install(3)(4)	SBLG2360	30	2 x 30		Amps
	SBLG2360S		2 x 30		Amps
Overload protection	-	Check Note 5			
Note 1: The motor drive features overtemperature protection, derating current and power when internal temperature reaches 85°C. Keep the cooling plate temperature below 75°C to maintain rated current at maximum ambient temperatures. Note 2: Max allowed power will start degrade from the selected value. Note 3: There are two power terminal inputs. Fuse should be installed in both of them for safety. Note 4: In dual channel controller, for operating only one channel install 30A fuse and for operating both channels 2 x 30A fuse should be installed. Power source must be capable to blow the fuse instantly in case of short circuit Note 5: Current limiting mechanism available through firmware. External overload motor protection can be used if required (provided by user) Note 6: Non-condensing					

STO Specifications

TABLE 14.

Parameter	Measure Point	Min	Typ	Max	Units
STO Input High Level	Ground to STO input pin		6	30 (1)	Volts
STO Input Low Level	Ground to STO input pin		0	1	Volts
STO Response Time	Input to output change		5		msec
STO Self Check Time	Internal		1080		msec
Cable Length	2				m
EMC Immunity	According to IEC 61800-3 and IEC 61800-5-2 Annex E				
CE Declaration	Available at www.roboteq.com				

Mechanical Specifications

TABLE 15.

Parameter	Measure Point	Min	Typ	Max	Units
Weight	Board		215 (0.47)		g (lbs)
Power Connectors Wiring	Screw terminal	22		14	AWG
Torque	D-sub standard connector		0.4 (3.54)		Nm (in-lbs)
Torque	Terminal block		0.8 (7.10)		Nm (in-lbs)
Torque	Mounting screws (4/M2.5)		0.36 (3.2)		Nm (in-lbs)
IP rating			IP40		

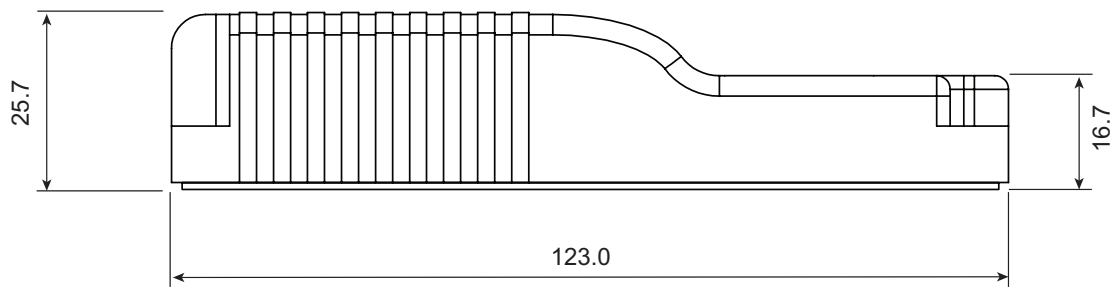


FIGURE 11. SBLG23xx Side View and Dimensions

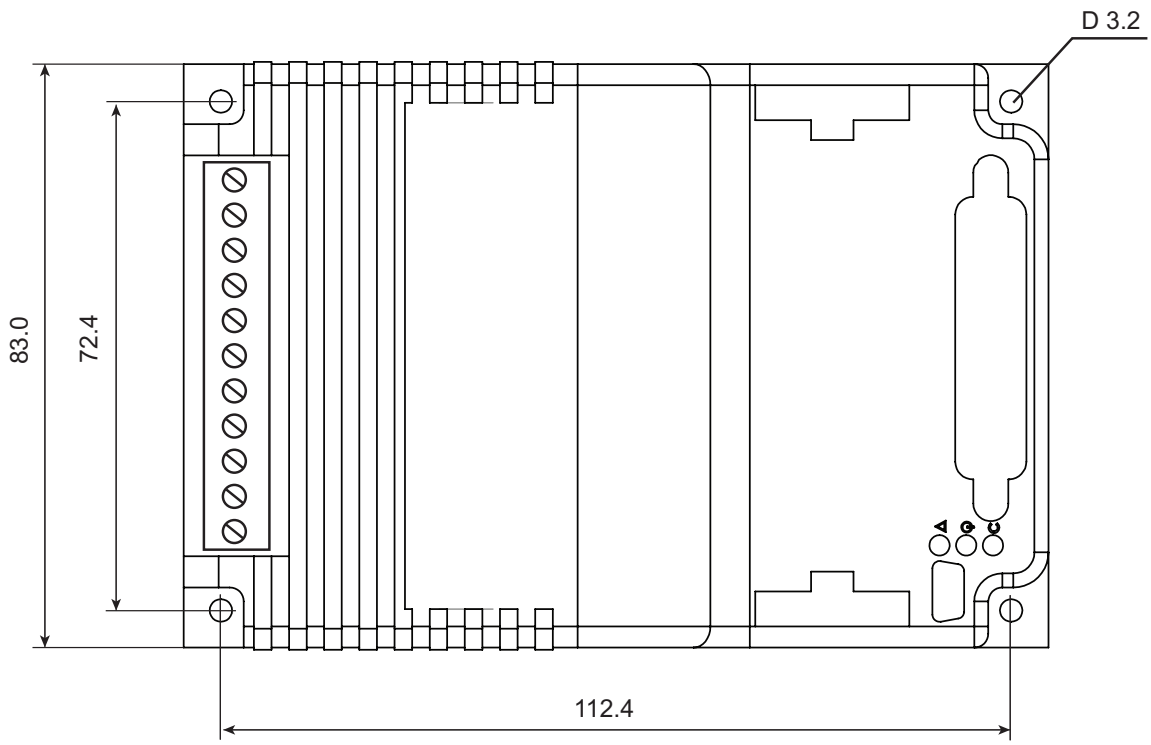


FIGURE 12. SBLG23xx Top View and Dimensions