

1x40A Single Channel Forward/Reverse Brushed DC Motor Controller



Roboteq's SDC1130 controller is designed to convert commands received from an RC radio, Analog Joystick, wireless modem, PC (via RS232) or microcomputer into high voltage and high current output for driving one DC motor. Fitting a very compact 70x70mm board, and designed for maximal ease-of-use, it is delivered with all necessary cables and hardware, and is ready to use in minutes.

The controller features a high-performance 32-bit microcomputer and quadrature encoder inputs to perform advanced motion control algorithms in Open Loop or Close Loop (Speed or Position) modes. The SDC1130 features several Analog, Pulse and Digital I/Os which can be remapped as command or feedback inputs, limit switches, or many other functions.

Numerous safety features are incorporated into the controller to ensure reliable and safe operation. The controller's operation can be extensively automated and customized using Basic Language scripts. The controller can be reprogrammed in the field with the latest features by downloading new operating software from Roboteq.

Applications

- Industrial Automation
- Fan & Pump Control
- Winch & Cranes
- Machine control
- Robotic actuators
- Automatic Guided Vehicles
- Terrestrial and Underwater Robotic Vehicles
- Telepresence Systems
- Animatronics

Features List

- RS232, 0-5V Analog, or Pulse (RC radio) command modes
- Auto switch between RS232 (12V levels or non-inverted TTL levels), Analog, or Pulse based on user-defined priority
- Input for direct connection to Spektrum digital RC radios
- Built-in high-power power drivers for one DC motor at up to 40A
- Support for 10 KOhm NTC temperature sensors through analog inputs (requires an external 10 KOhm pull-up resistor)
- Full forward & reverse control. Four quadrant operation. Supports regeneration
- Operates from a single power source
- Built-in programming language for automation and customization
- Programmable current limit up to 40A for protecting controller, motors, wiring and battery
- Up to 4 Analog Inputs for use as command and/or feedback
- Up to 5 Pulse Length, Duty Cycle or Frequency Inputs for use as command and/or feedback
- Up to 6 Digital Inputs for use as Deadman Switch, Limit Switch, Emergency stop or user inputs
- Quadrature Encoder input with 32-bit counter
- Built-in programming language for automatic operation and/or customized functionality
- 2 general purpose 40V, 1A output for brake release or accessories
- Selectable min, max, center and deadband in Pulse and Analog modes

- Selectable exponentiation factors for each command inputs
- Trigger action if Analog, Pulse or Encoder capture are outside user selectable range (soft limit switches)
- Open loop or closed loop speed control operation
- Closed loop position control with analog or pulse/frequency feedback
- Precise speed and position control when Encoder feedback is used
- PID control loop
- Configurable Data Logging of operating parameters on RS232 Output for telemetry or analysis
- Built-in Battery Voltage and Temperature sensors
- Power Control input for turning On or Off the controller from external microcomputer or switch
- No consumption by output stage when motors stopped
- Regulated 5V output for powering Encoders, RC radio, RF Modem or microcomputer
- Programmable acceleration and deceleration
- Programmable maximum forward and reverse power
- Ultra-efficient 5 mOhm ON resistance MOSFETs
- Stall detection and selectable triggered action if Amps is outside user-selected range
- Overvoltage and Undervoltage protection
- Programmable Watchdog for automatic motor shutdown in case of command loss
- Overtemperature protection
- Diagnostic LED
- Efficient heat sinking using conduction bottom plate. Operates without a fan in most applications
- Power wiring via terminal strip wires up to AWG12
- 2.76" (70mm) L, 2.76" W (70mm), 0.78" (20mm) H
- -40o to +85o C operating environment
- 3.5oz (100g)
- Easy configuration, tuning and monitory using provided PC utility
- Field upgradeable software for installing latest features via the internet.

Orderable Product References

TABLE 1.

Reference	Number of Channels	Amps/Channel	Volts
FBL2360	1	40	30

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.

Power Wires Identifications and Connection

Power connections are made through a 6 position screw terminal.

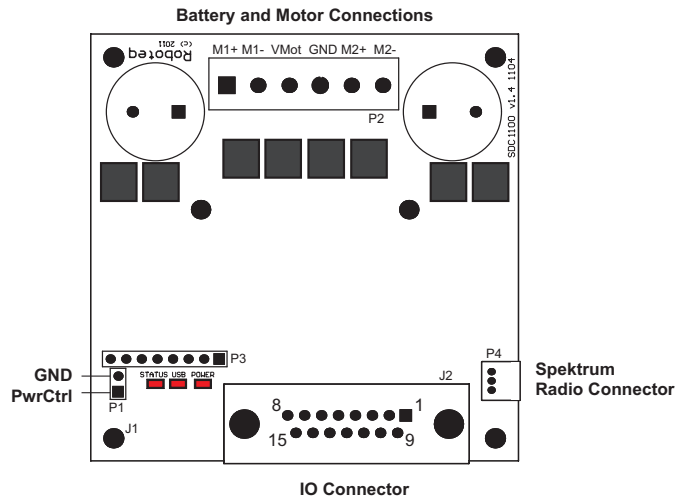


FIGURE 1. Controller layout

The diagram below shows how to wire the controller and how to turn power On and Off.

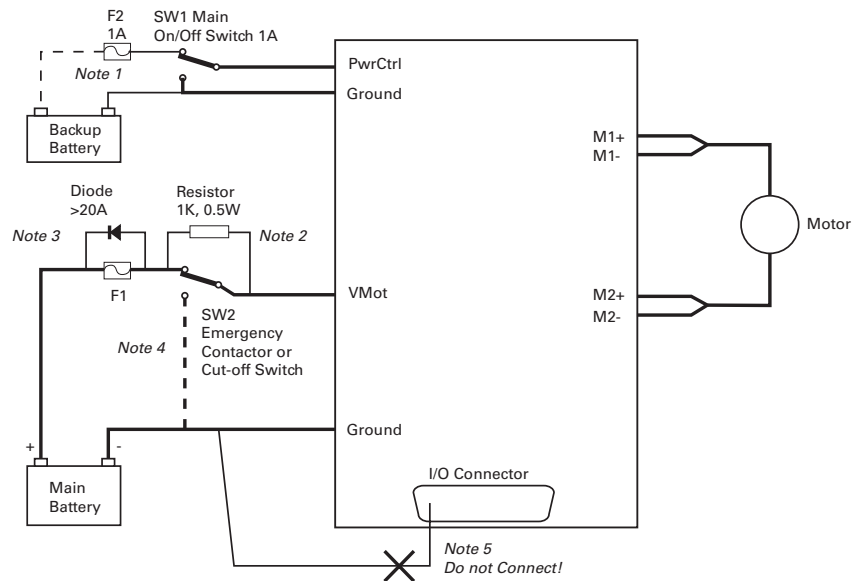


FIGURE 2. Powering the controller. Thick lines identify **MANDATORY** connections

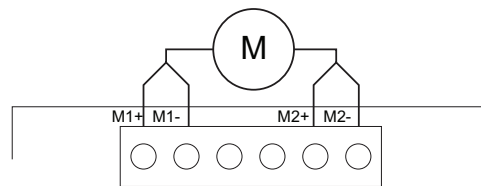


FIGURE 3. FBL2360 motor wiring detail

Caution

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

Mandatory Connections

It is imperative that the controller is connected as shown in the above diagram in order to ensure a safe and trouble-free operation. All connections shown as thick black lines are mandatory. The controller must be powered On/Off using switch SW1 on the Power Control Header.

Emergency Switch or Contactor

The battery must be connected in permanence to the controller's VMot power via an input emergency switch or contactor SW2 as additional safety measure. The user must be able to deactivate the switch or contactor at any time, independently of the controller state.

Sensor and Commands Connection

Connection to RC Radio, Microcomputer, Joystick and other low current sensors and actuators is done via the 15 connector located in front of the board. The functions of many pins vary depending on user configuration. Pin assignment is found in the table below.

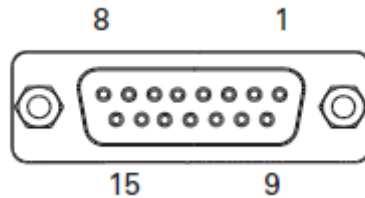


FIGURE 5. Connector pin locations

TABLE 2.

Connector Pin	Power	Dout	Com	RC	Ana	Dinput	Enc	Default Config
1		DOUT1						Motor Brake
9		DOUT2						Safety Contactor
2			TxOut					RS232Tx
10				RC5	ANA1 (1)	DIN5		AnaCmd (3)
3			RxIn					RS232Rx
11				RC4	ANA4	DIN4		Unused
4				RC1		DIN1	ENCA (2)	RCRadio/ Encoder (1)
12				RC3	ANA3	DIN3		Unused
5	GND							
13	GND							
6			TTL TxD / SCL I					TTL Serial TxD
14	5VOut							
7			TTL Rx D / SDA I					TTL Serial Rx D
15						DIN6		Unused
8				RC2	ANA2	DIN2	ENCB (2)	Encoder (1)

Note 1: Pin assignment for this signal may differ from other Roboteq controller models.
 Note 2: Encoder input requires RC inputs 1, 2, 3 and 4 to be disabled. Encoder is disabled in factory default.
 Note 3: Analog command is disabled in factory default configuration.

Default I/O Configuration

The controller can be configured so that practically any Digital, Analog and RC pin can be used for any purpose. The controller's factory default configuration provides an assignment that is suitable for most applications. The figure below shows how to wire the controller to two analog potentiometers, an RC radio, and the RS232 port. It also shows how to connect the two outputs to motor brake solenoids. You may omit any connection that is not required in your application. The controller automatically arbitrates the command priorities depending on the presence of a valid command signal in the following order: 1-RS232, 2-RC Pulse, 3-None. If needed, use the Roborun+ PC Utility to change the pin assignments and the command priority order.

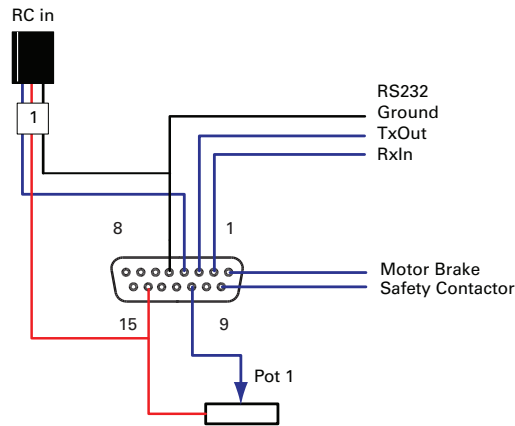


FIGURE 6. Factory default pins assignment

Enabling Analog Commands

For safety reasons, the Analog command mode is disabled by default. To enable the Analog mode, use the PC utility and set Analog in Command Priority 2 or 3 (leave Serial as priority 1). Note that by default the additional securities are enabled and will prevent the motor from starting unless the potentiometer is centered, or if the voltage is below 0.25V or above 4.75V. The drawing shows suggested assignment of Pot 1 to ANA4. Use the PC utility to enable and assign analog inputs.

Connecting Thermistors

10 KOhm 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 10 KOhm pull-up resistor 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.

Status LED Flashing Patterns

After the controller is powered on, the Power LED will turn on, indicating that the controller is On. The Status LED will be flashing at a 2 seconds interval. The flashing pattern provides operating or exception status information.



FIGURE 7. Normal Operation Flashing Patterns

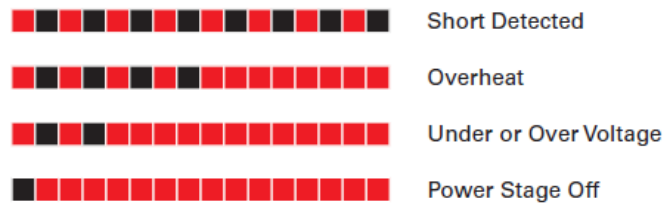


FIGURE 8. Exception or Fault Flashing Patterns

Additional status information may be obtained by monitoring the controller with the PC utility.

Electrical Specifications

Absolute Maximum Values

The values in the table below should never be exceeded. Permanent damage to the controller may result.

TABLE 3.

Parameter	Measure point	Min	Typ	Max	Units
Battery Leads Voltage	Ground to VMot	10		35	Volts
Reverse Voltage on Battery Leads	Ground to VMot	-1			Volts
Motor Leads Voltage	Ground to M+, M-			35	Volts
Digital Output Voltage	Ground to Output pins			30	Volts
Analog and Digital Inputs Voltage	Ground to any signal pin on 15-pin connectors			15	Volts
RS232 I/O pins Voltage	External voltage applied to Rx/Tx pins			15	Volts
Board Temperature	Board	-40		85	oC
Humidity	Board			100 (2)	%

Note 1: Maximum regeneration voltage in normal operation. Never inject a DC voltage from a battery or other fixed source.
 Note 2: Non-condensing.

Power Stage Electrical Specifications (at 25oC ambient)

TABLE 4.

Parameter	Measure point	Min	Typ	Max	Units
Battery Leads Voltage	Ground to VMot	10 (1)		35	Volts
Motor Leads Voltage	Ground to M+, M-	0 (1)		35 (2)	Volts
Over Voltage protection range	Ground to VMot	5	30 (4)	35 (2)	Volts
Under Voltage protection range	Ground to VMot	0	5 (4)	35	Volts
Idle Current Consumption	VMot or Pwr Ctrl wires	50	75 (5)	100	mA
ON Resistance (Excluding wire resistance)	VMot to M+, plus M- to Ground at 100% power		10		mOhm
Max Current for 30s	Motor current			40 (6)	Amps
Continuous Max Current	Motor current			20 (7)	Amps
Current Limit range	Motor current	1	30 (8)	40	Amps
Stall Detection Amps range	Motor current	1	30 (8)	40	Amps
Stall Detection timeout range	Motor current	1	500 (9)	65000	milliseconds
Motor Acceleration/Deceleration range	Motor current	100	500 (10)	65000	milliseconds

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

Note 2: Maximum regeneration voltage in normal operation. Never inject a DC voltage from a battery or other fixed source.

Note 3: Minimum voltage must be present on VMot 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 VMot or PwrCtrl wires.

Note 6: Max value is determined by current limit setting. Duration is estimated and is dependent on ambient temperature cooling condition.

Note 7: Estimate. Limited by heatsink temperature. Current may be higher with better cooling.

Note 8: Factory default value. Adjustable in 0.1A increments.

Note 9: Factory default value. Time in ms that Stall current must be exceeded for detection.

Note 10: Factory default value. Time in ms for power to go from 0 to 100%.

Warning

Beware that regenerative braking can create high voltage at the controller's power inputs. Use the controller only with batteries. See user manual for special precautions when using a power supply.

Command, I/O and Sensor Signals Specifications

TABLE 5.

Parameter	Measure point	Min	Typ	Max	Units
Main 5V Output Voltage	Ground to 5V pins on DSub15	4.6	4.75	4.9	Volts
5V Output Current	5V pin on DSub15			100	mA
Digital Output Voltage	Ground to Output pins			40	Volts
Digital Output Current	Output pins, sink current			1	Amps
Output On resistance	Output pin to ground		0.75	1.5	Ohm
Output Short circuit threshold	Output pin	1.05	1.4	1.75	Amps
Input Impedances	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		15	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	20 000		10	us
Pulse repeat rate	Pulse inputs	50		250	Hz
Pulse Capture Resolution	Pulse inputs		1		us
Frequency Capture	Pulse inputs	100		10 000	Hz
Encoder count	Internal	-2.147		2.147	10 ⁹ Counts
Encoder frequency	Encoder input pins			200	KHz

Note1: Encoder input requires Pulse capture to be disabled on inputs RC1, RC2, RC3 and RC4

Operating & Timing Specifications

TABLE 6.

Parameter	Measure Point	Min	Typ	Max	Units
Command Latency	Command to output change	0	2.5	5	ms
PWM Frequency	Motor outputs	10	18 (1)	20	kHz
Closed Loop update rate	Internal		200		Hz
RS232 baud rate	Rx & Tx pins		115 200 (2)		Bits/s
RS232 Watchdog timeout	Rx pin	1 (3)		65 000	ms

Note 1: May be adjusted with configuration program
 Note 2: 115 200, 8-bit, no parity, 1 stop bit, no flow control
 Note 3: May be disabled with value 0

Scripting

TABLE 7.

Parameter	Measure Point	Min	Typ	Max	Units
Scripting Flash Memory	Internal		2048		Bytes
Max Basic Language programs	Internal		500	750	Lines
Integer Variables	Internal			64	Words (1)
Boolean Variables	Internal			1024	Symbols
Execution Speed	Internal	15 000	30 000		Lines/s
Note 1: 32-bit words					

Thermal Specifications

TABLE 8.

Parameter	Measure Point	Min	Typ	Max	Units
Board Temperature	PCB	-40		85 (1)	oC
Thermal Protection range	PCB	70		80 (2)	oC
Thermal resistance	Power MOSFETs to heats sink			2	oC/W
Note 1: Thermal protection will protect the controller power					
Note 2: Max allowed power out starts lowering at minimum of range, down to 0 at max of range					

The SDC1130 uses a conduction plate at the bottom of the board for heat extraction. For best results, attach firmly with thermal compound paste against a metallic chassis so that heat transfers to the conduction plate to the chassis. If no metallic surface is available, mount the controller on spacers so that forced or natural air flow can go over the plate surface to remove heat.

Mechanical Specifications

TABLE 9.

Parameter	Measure Point	Min	Typ	Max	Units
Weight	Board		100 (3.5)		g (oz.)
Power Wire Gauge	Terminal strip			12	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)

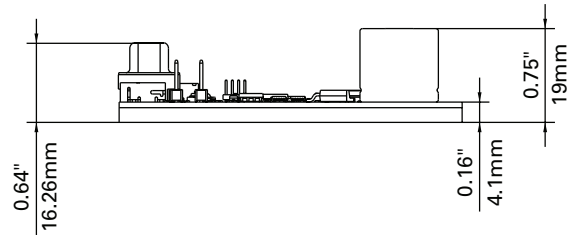


FIGURE 9. SDC1130 front view and dimensions

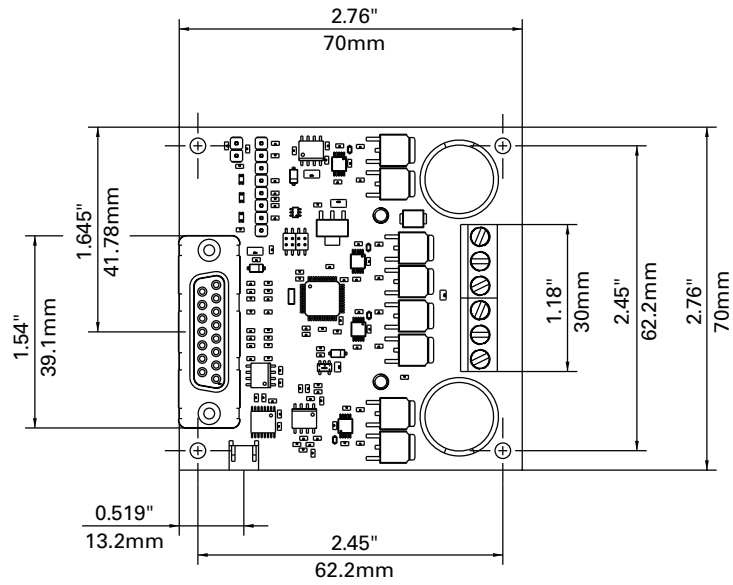


FIGURE 10. SDC1130 top view and dimensions