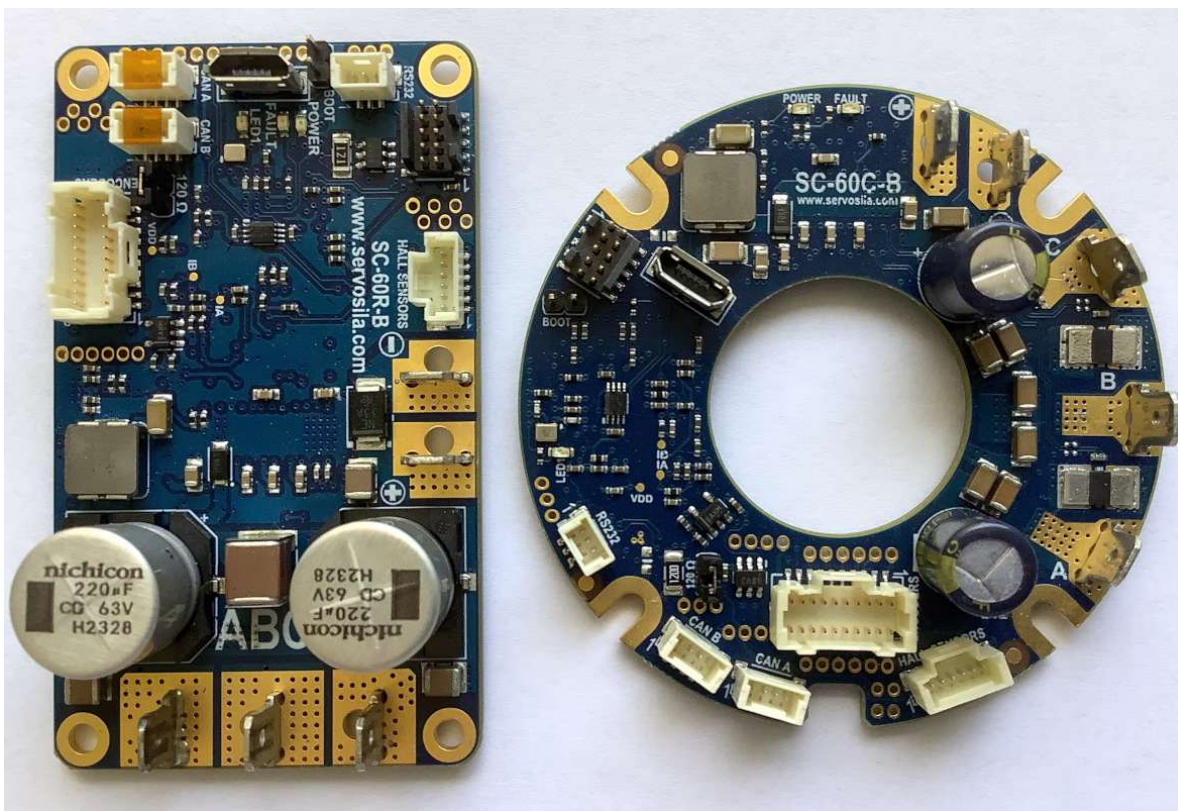


Servosila SC-60 Servo Drives

Datasheet

Revision E (March 2026)



www.servosila.com/en/motion-control

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Introduction

Servosila SC-60 Servo Drives come in two form factors, a rectangular one (SC-60R) and a circular one (SC-60C). Both models are identical in terms of capabilities, features, firmware, and external electrical connectors. Industrial designers might prefer one model over the other depending on what motor-actuated mechanisms they are working on. At the same time, both electrical and software engineers rest assured that whichever model is chosen for a particular design, a full electrical and software compatibility is still in place.

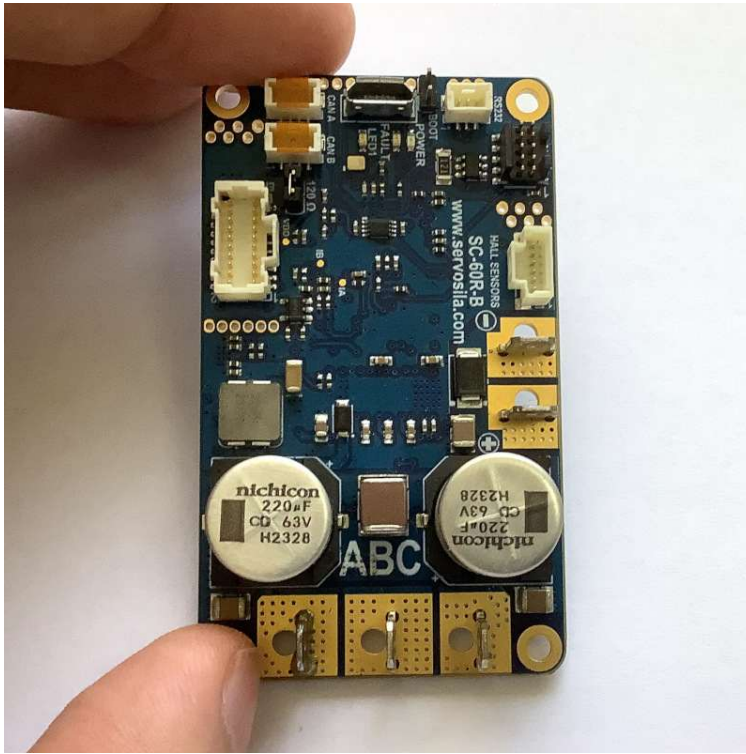


Figure 1: SC-60R



Figure 2: SC-60C

The servo drives come with connectors for attaching motor phase cables, DC power cables, up to two encoders, and information buses. All the connectors are intentionally placed on the front side of the boards only. There are no connectors on the back side of the boards. The back side is intended for installation of an (optional) heat sink, or for attaching the boards directly to an enclosure designed to act as a heat sink.

All the connectors face upwards, perpendicular to the boards. None of the connectors face sideways. This arrangement simplifies cable routing within cramped spaces such as cylindrical enclosures of servo actuators or mobile chassis. Besides the connectors, the servo drives come with **soldering holes** (soldering contacts) for every signal or power line. The soldering holes allow cables to be soldered directly to the boards to form vibration-resistant connections.

The servo drives feature two identical parallel CAN bus ports. This simplifies cabling of multiple servo drives into a chain, for example, inside a robotic arm manipulator or a robotic chassis, and streamlines in-the-field repair or replacement process. There is a USB port as well as an RC PWM input for controlling the servo drives.

There is a way to upgrade the servo drives' firmware via a RS232 port, including field firmware upgrades of servo actuators or mobile vehicles.

Technical Specifications

Parameter	Description
Supported kinds of electric motors	Brushless DC Motors (PMSM, BLDC). Sensored or Sensorless. Brushed Motors (Full Support including ESC & Servo mode)
Number of simultaneously connected motors: - brushless motors - brushed motors or solenoids	1 brushless motor, or 1 brushed motors or solenoid
Nominal Current (Motor Phase Current)	Firmware-selectable: <i>Option 1:</i> 40 Arms or 60 A by amplitude <i>Option 2:</i> 10 Arms or 15 A by amplitude
Short-Term Peak Current (ADC range limit)	60% above the selected Nominal Current
Input voltage	7-60 V DC
Switching (PWM) Frequency	Firmware-selectable: 15kHz, 30kHz (default), 48 kHz, or other switching frequency in between.
Control Loop Frequency	Firmware-selectable: 15kHz (default), 16kHz, 17kHz, 18kHz, or any other frequency in between. Position, Velocity and Torque/Current Control operate at the same frequency (1:1:1).
Operation modes	Electronic Torque Control (ETC), Electronic Speed Control (ESC), Servo Control, Direct Drive Control, Brake, Energy Recuperation, Auto-Configuration/System Identification.
Supported algorithms of brushless motor control	Field-Oriented Control (FOC),

	Sensorless Observer Hall Sensors Observer, D-Q axis Coupling Compensation, Field Weakening, Numerous Servo Control features, Protections, Notch Filters, Low Pass Filters, Acceleration Control
Auto configuration (system identification) function	Yes
Hall Sensors input (discrete)	Yes (“single-ended”)
Interfaces to absolute position encoders	BISS-C (unidirectional), SSI, SPI, PWM, Quadrature with Index Signal (“single-ended”)
Max. resolution of encoder	32 bit
Built-in network router	Built-in USB-to-CAN router («USB2CAN dongle»).
Control Interfaces	CAN bus with CANopen application protocol. USB 2.0, a virtual COM port, with SLCAN application protocol. RC PWM control interface
CAN bus Terminal Resistor 120 Ohm	Yes (jumper controlled)
Supported CANbus bit rates	1 mbit/sec, 500 kbit/sec, 250 kbit/sec, 125 kbit/sec, 100 kbit/sec, 50 kbit/sec
CAN bus ports	2 (parallel)
USB 2.0 ports	1
GPIO functions	2x Limit Switch inputs 1x Emergency Stop input 1x dedicated GPIO output (discrete or PWM signal) 1x dedicated GPIO input (discrete)
Supported operating systems	Linux (no driver is needed) including Debian, Ubuntu Windows 11 (no driver is needed) Windows 10 (no driver is needed) Windows 8 (driver is provided) Windows 7 (driver is provided)
Programming APIs	CANopen,

	Linux SocketCAN API, SLCAN protocol via a virtual COM-port (USB2.0) for Windows 11, 10, 8, 7 and Linux, G-code, DLL API for Python, C++, C#
Servosila Motion Controller Software	Yes (included, free)
Software Servo Drive Simulator	Yes (included, free)
Dimensions: - Model SC-60R (rectangular) - Model SC-60C (circular)	68mm x 40mm x 16mm Outer diameter: 60 mm. Inner diameter: 24mm. Height: 16 mm.
Weight	~50 g
Power consumption when idling	120-180 mA depending on connected peripherals

Compatibility Criteria for Brushless Motors

The SC-60 servo drives are capable of controlling a wide range of brushless motors. However, there are certain limitations applied to the brushless motors' specifications. Use the following rules when selecting a brushless motor for use with SC-60 servo drive.

Rule #1: Motor Phase-to-Phase Maximum Current Limit

Nominal current < 60 A

If your motor has higher nominal current than the provided value, the motor will likely not work well with SC-60 servo drive.

Rule #2: Electrical Time Constant Limit

Verify that $L/R > 0.00018$

where **L** is a phase-to-phase inductance, and **R** is a phase-to-phase resistance. Get these from the motor's datasheet.

If the ratio is less than the specified value, then the motor is not likely to work well with the SC-60 servo drive. Please consult with Servosila Technical Support in such a case.

Rule #3: Max Speed Limit

Verify that

$(RPM/60) * (Poles/2) < 1200$ (electrical Hz) for Sensorless motors or direct drive motors with Encoders, or

$(RPM/60) * (Poles/2) < 800$ (electrical Hz), if Hall Sensors are used for motor phase commutation,

where **RPM** is a no-load speed of the motor at the used input voltage, and **Poles** is the number of rotor poles. Get these from the motor's datasheet.

If the output of the formula is more than the specified value, then the motor is not likely to work well with the SC-60 servo drive.

Rule #4: Motor Nominal Voltage

The motor's Nominal Voltage must be less than or equal to 60 V DC.

The optimal / most practical voltage limit is 52 V DC.

Note: Make sure that all the rules hold when selecting a brushless motor for use with SC-60 servo drive.

Servosila SC-60R: Layout

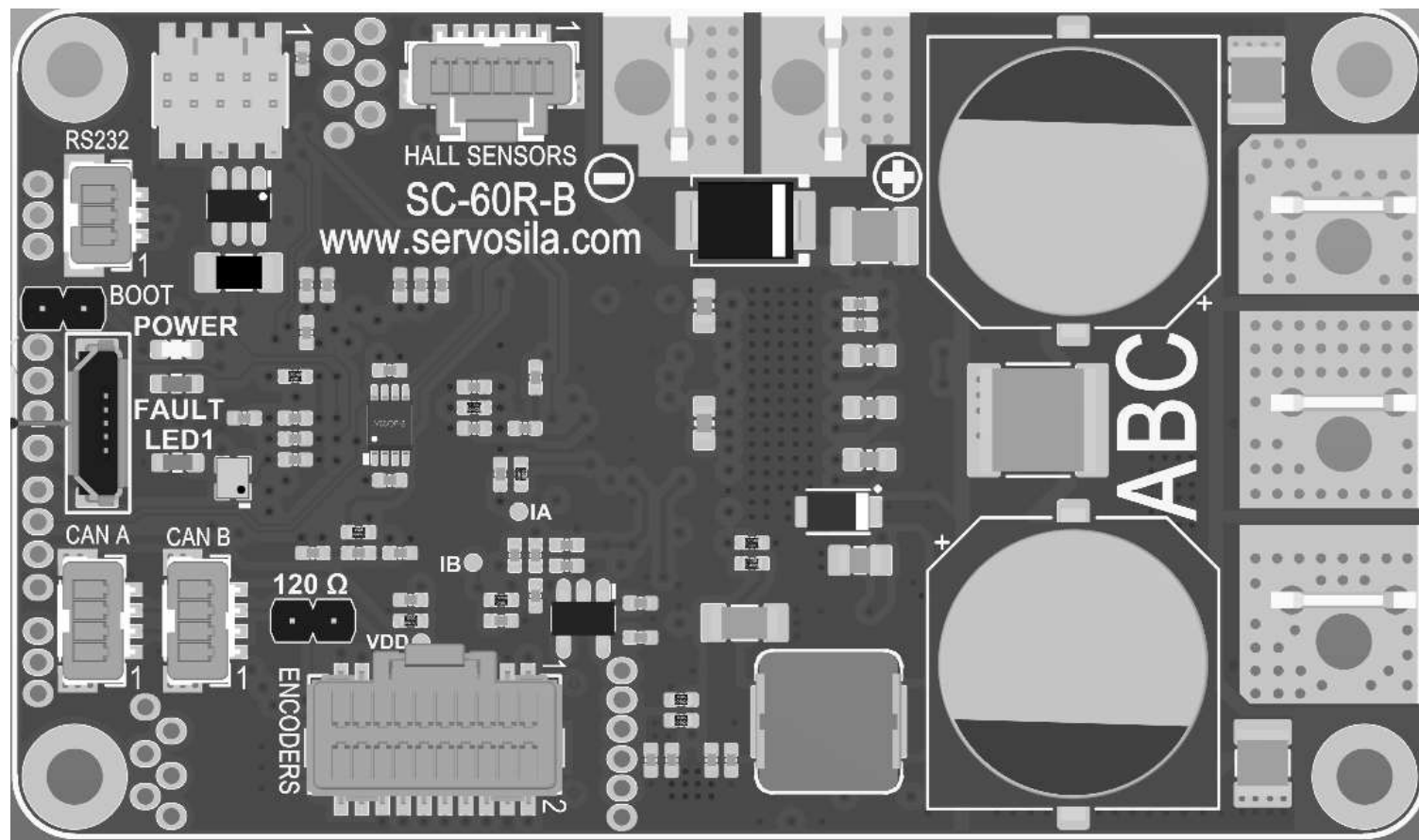


Figure 3: Servosila SC-60R - Front side

Servosila SC-60C: Layout

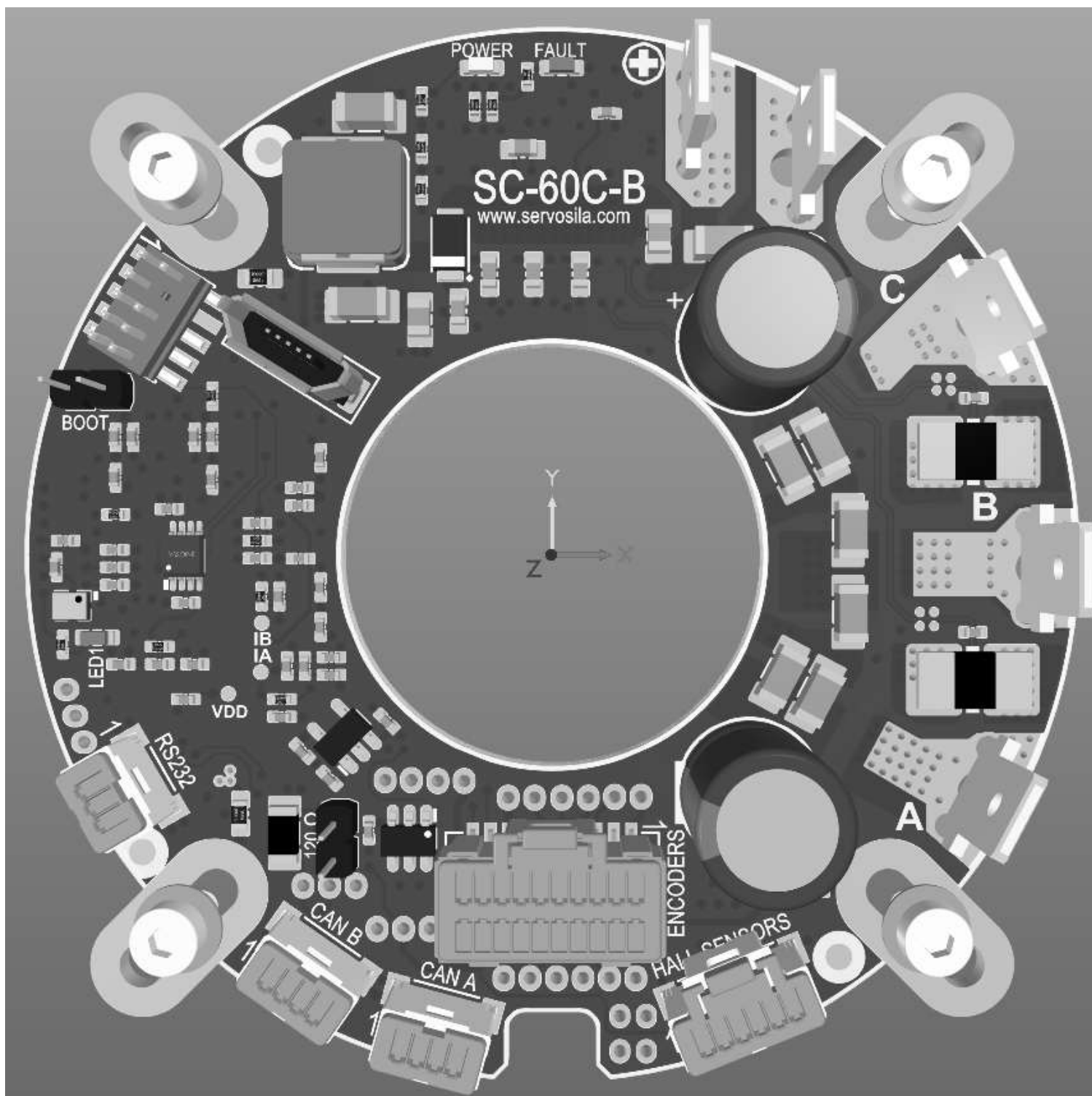


Figure 4: Servosila SC-60C – Front side

Electrical Connectors & Part Numbers

Connector	Purpose	Part #	Mates to Part #
ENCODERS	SSI, BISS-C, SPI, PWM input, Quadrature input <i>Alternative purposes: GPIO limit switches, emergency stop, dedicated input or output pins.</i>	Molex 5011902027	Molex 5011892010 Pre-crimped leads: Molex 0797581019
USB	USB2.0 MICRO B port	Würth Elektronik 614105150721	USB2.0 MICRO B male
CAN A	CAN bus port A (parallel to port CAN B)	Molex 5013310407	Molex 5013300400 Pre-crimped leads: Molex 0797581019
CAN B	CAN bus port B (parallel to port CAN A)	same	same
RS232	Firmware re-flashing port	Molex 5013310307	Molex 5013300300 Pre-crimped leads: Molex 0797581019
HALL SENSORS	Hall Sensors (discrete) <i>Alternative purposes: GPIO limit switches, emergency stop, dedicated input or output pins.</i>	Molex 5013310607	Molex 5013300600 Pre-crimped leads: Molex 0797581019
-	Power Supply Negative (<i>polarity sensitive!</i>) <i>Twist “-“ and “+” power wires at intervals of 100mm, for better noise immunity. Use shorter wires, whenever possible.</i> <i>To improve EMI/EMC characteristics, consider using shielded twisted power cable and (optionally) installing ferrite ring filters on the power wires in the shield’s gap. Connect the motor shield to a ground at the power supply/battery side.</i>	TE Connectivity AMP Connectors 1-726388-2	TE Connectivity AMP Connectors 2293255-1
+	Power Supply Positive (<i>polarity sensitive!</i>)	same	same
A	Brushless Motor Phase A or Brushed Motor “+” <i>Do not twist or bundle brushless motor phase wires.</i> <i>The motor phase wires are a major source of electromagnetic emissions. Use shorter motor phase cables, whenever possible. To improve EMI/EMC</i>	same	same

Connector	Purpose	Part #	Mates to Part #
	<i>characteristics, consider using shielded (not twisted) motor cables and (optionally) installing ferrite ring filters on the motor phase wires in the shield's gaps. Connect the cable shield to a ground connection at the motor end.</i>		
B	Brushless Motor Phase B or <i>Brushed Motor “-”</i>	same	same
C	Brushless Motor Phase C	same	same

Pre-crimped leads are Molex [0797581019](#), Molex 0797581018

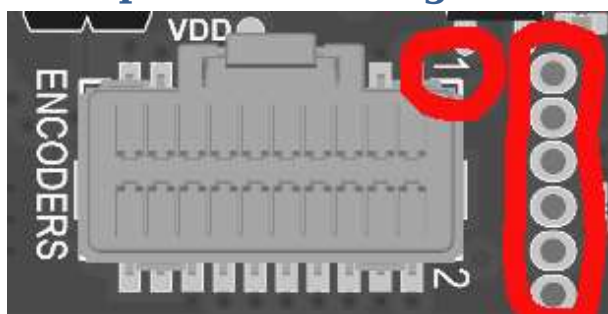
Jumpers

Label	Purpose	Part #
120 Ohm	The jumper turns on (once installed) a 120 Ohm terminal resistance required by the CAN bus. Install the jumper on one of the servo drives in a CAN network.	Sullins Connector Solutions SPN02SYBN-RC
Boot	The jumper (once installed) switches the servo drive into a firmware re-flashing mode. Do not forget to remove the jumper after finishing the re-flashing procedure!	same

LEDs

Label	Purpose
POWER	This LED is directly wired to power supply lines. The LED turns on whenever a power supply is connected to “+” and “-” terminals of the servo drive.
FAULT	This LED turns on whenever firmware detects a fault or multiple simultaneous faults. A telemetry parameter “Fault Bits” tells what faults have caused the problem. Note that the firmware latches into a FAULT mode before turning the LED on. In this mode, the motor is de-energized and the firmware stops responding to any command rather than the RESET command. Send a RESET command to the servo drive in order to clear the fault latches and switch the servo drive back into an operational mode once the fault is rectified.
LED1	The LED turns on whenever the servo drive receives a command from a parent control system via either CAN or USB. The LED indicates that a parent control system is successfully communicating to the servo drive.

First pin & Soldering Holes



First pin of every connector is labeled with a “1” sign.

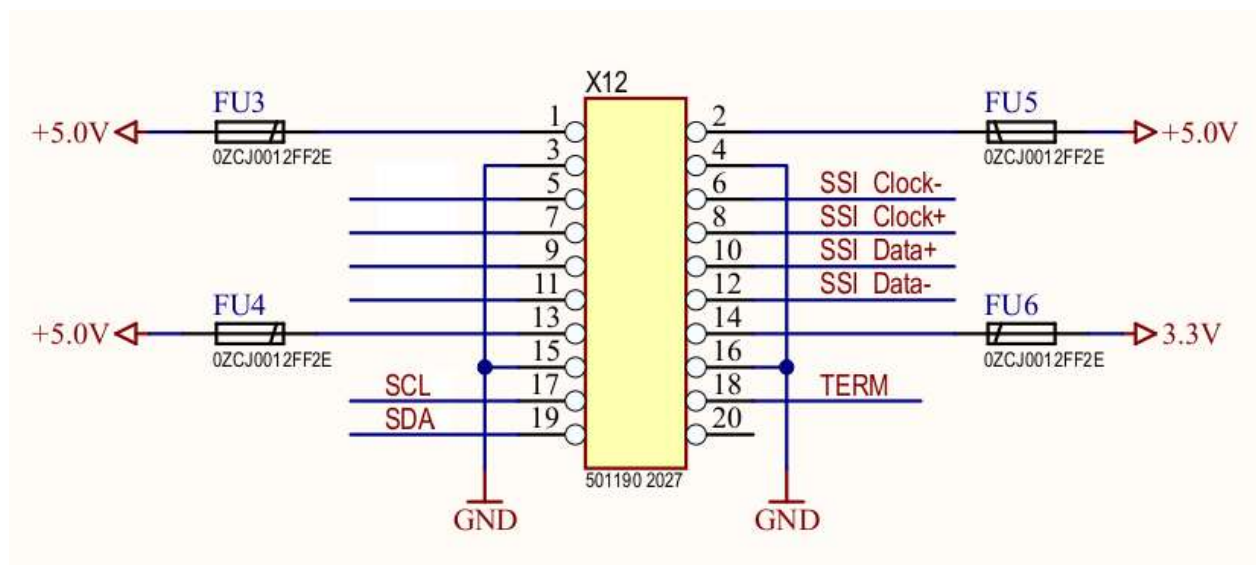
The servo drives come with **soldering holes** for every signal or power line. The soldering holes allow cables to be soldered directly to the boards from either side to form vibration-resistant connections. Use a multimeter to match pins vs. soldering holes (“buzz the circuit”).

ENCODERS connector

The ENCODERS connector is intended for connecting absolute position encoders via digital interfaces. The supported interfaces are SSI, BISS-C (unidirectional), SPI, Quadrature (single-ended), or PWM.

Note that SPI, Quadrature and PWM interfaces share pins. In contrast, the SSI/BISS-C interface comes with a dedicated set of pins. This interface can be used together with other encoder interfaces such as SPI, PWM or Quadrature. If two encoders are to be simultaneously connected to the same SC-60 servo drive, one of the encoders must use SSI/BISS-C interface since the other interfaces share pins.

Schematics



Pins

Pin #	Purpose	Pin #	Purpose
1	+5.0 (power output , fuse-protected)	2	+5.0 (power output , fuse-protected)
3	GND	4	GND
5	Quadrature "A" or SPI SOMI	6	SSI bus Clock-
7	Quadrature "B" or SPI CLK	8	SSI bus Clock+
9	Quadrature Index ("Z") or SPI SS (Slave Select) or PWM input or RC PWM input	10	SSI bus Data+
11	SPI SIMO	12	SSI bus Data-

13	+5.0 (power output , fuse-protected)	14	+5.0 (power output , fuse-protected)
15	GND	16	GND
17	I2C bus SCL (not used, firmware-specific) <i>This pin can be used for GPIO output (5V)</i>	18	Thermistor input, 10kOhm
19	I2C bus SDA (not used, firmware-specific) <i>This pin can be used for GPIO output (5V)</i>	20	Not used

SSI/BISS-C

Wire	Pin #	Description
+5.0V	2	Power output , fuse-protected
GND	4	Ground
Clock-	6	Clock, differential, twisted pair
Clock+	8	Clock, differential, twisted pair
Data+	10	Data, differential, twisted pair
Data-	12	Data, differential, twisted pair

The BISS-C interface is unidirectional. Maximum supported output clock frequency is 12.5 MHz.

It is recommended to twist “Clock+” and “Clock-” wires into a twisted pair, and also twist “Data+” and “Data-” wires into a second twisted pair.

SPI

Wire	Pin #	Description
+5.0V	1	Power output , fuse-protected
GND	3	Ground
SOMI	5	Slave output, master input
CLK	7	Clock
SS	9	Slave select
SIMO	11	Slave input, master output (not used, firmware-specific)

Maximum supported output clock frequency is 12.5 MHz.

PWM Input Interface

Wire	Pin #	Description
+5.0V	1	Power output , fuse-protected
GND	3	Ground
PWM	9	PWM input signal

Maximum input pulse frequency is 5MHz.

Quadrature Interface

Wire	Pin #	Description
+5.0V	1	Power output , fuse-protected
GND	3	Ground
A	5	Signal “A”
B	7	Signal “B”
I	9	Index Signal (signal “Z”)

Both “push-pull” and “open collector” connections are supported.

The quadrature interface is “single-ended” (not a “differential” one). In order to connect an encoder with “differential” signals, connect just one of the wires in each pair. Try “inverted” signal first; if it does not work, try the normal signal next. Use telemetry to verify received signals.

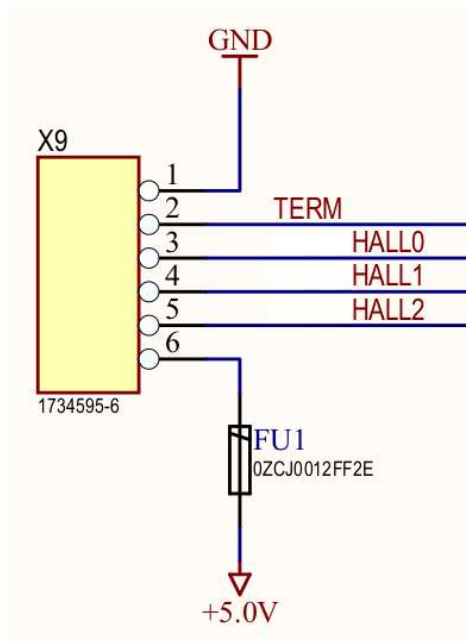
Maximum input pulse frequency is 5MHz.

Input signal voltages:

- Less than 0.4V is logical “low”,
- More than 2.4V is logical “high”.

Hall Sensors connector

Schematics



Pins

Pin #	Purpose
1	Ground
2	Thermistor input, 10kOhm
3	Hall signal 0 (discrete)
4	Hall signal 1 (discrete) or RC PWM input
5	Hall signal 2 (discrete)
6	+5.0V, power supply

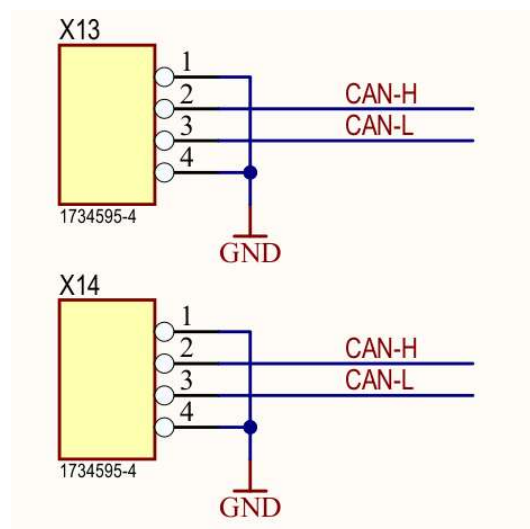
The Hall Sensors interface is “single-ended” (not a “differential” one). Both “push-pull” and “open collector” connections are supported.

CAN bus connectors (CAN A, CAN B)

The servo drives feature two identical parallel CAN bus ports. This simplifies cabling of multiple servo drives into a chain, for example, inside a robotic arm manipulator or a robotic chassis, and streamlines in-the-field repair or replacement process.

The servo drives come with an on-board terminal 120 Ohm resistor prescribed by the CAN bus standard. The resistor can be turned on or off via a jumper. Only one servo drive in a chain needs to have the terminal resistor enabled.

Schematics



Pins

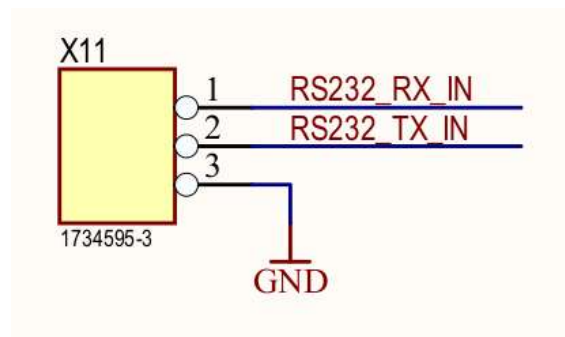
Pin #	Purpose
1	Ground
2	CAN high (twist)
3	CAN low (twist)
4	Ground

Supported bit rates are 1 mbit/sec, 500 kbit/sec, 250 kbit/sec, 125 kbit/sec, 100 kbit/sec, and 50 kbit/sec. It is recommended to twist “CAN high” and “CAN low” wires into a twisted pair.

Firmware re-flashing port (RS232)

The RS232 port is used for re-flashing the servo drive’s firmware. The port is not used for anything else.

Schematics



Pins

Pin #	Purpose
1	RX, serial receive
2	TX, serial transmit
3	Ground

GPIO input/output

Available GPIO pins

The SC-60 servo drives do not have dedicated GPIO pins or connectors. However, unused pins in ENCODERS connector or Hall Sensors connector can be re-purposed to perform input-output functions. Thus, a different selection of free pins is available for performing GPIO functions depending on what encoder interface is used and on whether or not a motor comes with Hall sensors.

Use the following tables to determine which pins are available for GPIO purposes, and what GPIO numbers correspond to particular pins.

Note:

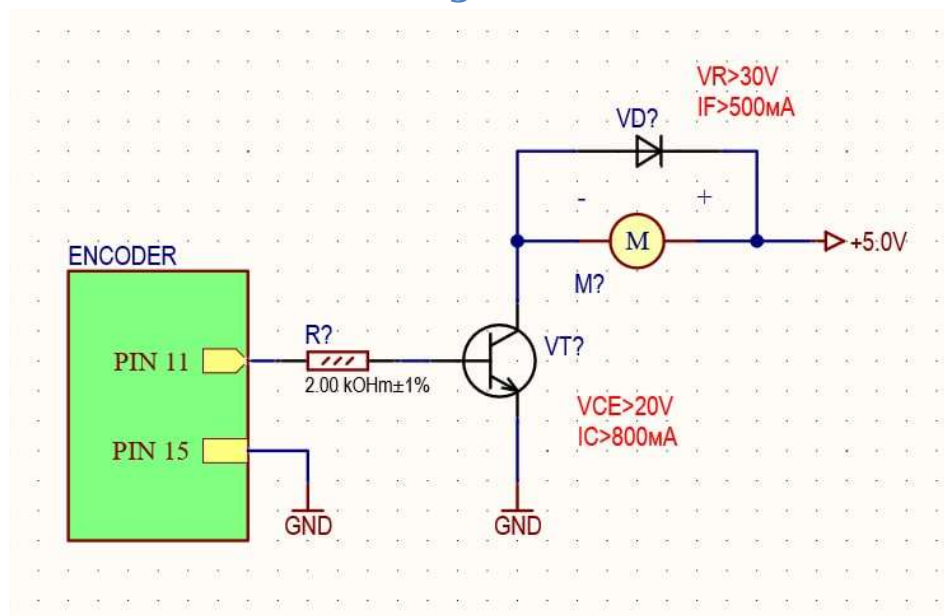
- The GPIO numbers listed in the tables below are needed when configuring GPIO functions such as limit switches, emergency stop, or generic input/output functions in Servoscope software.
- If a GPIO pin is used as an *output* pin, an **external resistor** should be added into the circuit. The tables below provide nominal values for the resistors. Refer to a schematics diagram below.

Pin in ENCODERS connector	Direction	Primary purpose	GPIO number	External resistor <i>if used as GPIO output</i>	Output Voltage <i>if used as GPIO output</i>
8	output only	SSI Clock+	GPIO14	3.3kOhm	3.3V
10	input only	SSI Data+	GPIO13	2kOhm	
5	output, input	SPI MISO or Quadrature A	GPIO17	2kOhm	3.3V
7	output, input	SPI CLK or Quadrature B	GPIO18	2kOhm	3.3V
9	output, input	SPI CS or Quadrature I or PWM input	GPIO19	2kOhm	3.3V
11	output, input	SPI SIMO	GPIO16	2kOhm	3.3V
17	output only	I2C SCLA	GPIO33	0 Ohm	5 V
19	output only	I2C SDAA	GPIO32	0 Ohm	5 V

(continued ...)

Pin in D_HALLS connector	Direction	Primary purpose	GPIO number	External resistor <i>if used as GPIO output</i>	Output Voltage <i>if used as GPIO output</i>
3	output, input	Hall 0	GPIO11	2kOhm	3.3V
4	output, input	Hall 1	GPIO7	2kOhm	3.3V
5	output, input	Hall 2	GPIO9	2kOhm	3.3V

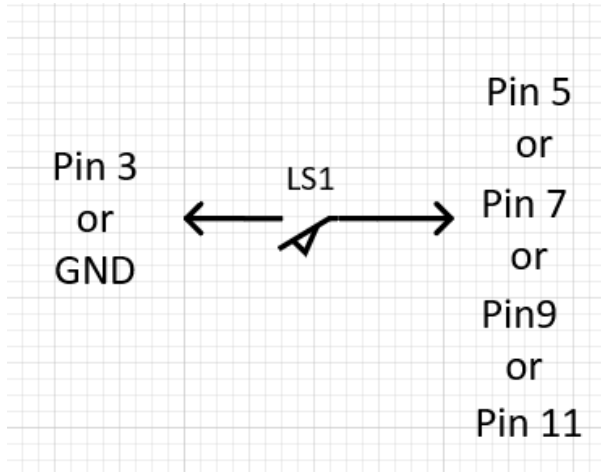
Schematics: controlling an External Brake via GPIO output



The diagram shows how to connect an external brake/solenoid to one of [GPIO output](#) pins. Choose either a 3.3V or a 5V output-capable pin.

Note: the nominal value of the resistor depends on the chosen pin. Refer to tables above for proper selection of the nominal value.

Schematics: Limit Switch or Emergency Stop



The diagram demonstrates a way to connect a Limit Switch or Emergency Stop via pins in ENCODERS connector. A similar approach works with pins of the D HALLS connector.

Receiving an RC PWM control signal

The SC-60 servo drives are capable of receiving a PWM control signal from an RC receiver such as Futaba or from a PLC with PWM output. A *duty cycle* of the PWM signal is used as a control input for speed control or servo control.

Note:

- **Common ground (!!!):** Interconnected SC-60 servo drive and RC receiver/PLC **must** have a common ground.
- The input PWM signal should have 5V amplitude. It *may* work with 3.3 V signal.

There are two options for connecting a cable carrying an RC PWM signal. It can be connected to either D_HALL connector or to ENCODERS connector as shown in the table below:

OPTION #1: D_HALL connector	OPTION #2: ENCODERS connector
Pin 1: connect to GND wire of RC receiver/PLC	Pin 3: connect to GND wire of RC receiver/PLC
Pin 4: connect to PWM output wire of RC receiver/PLC	Pin 9: connect to PWM output wire of RC receiver/PLC

Power Supply

The servo drives require 7.0 – 60.0 V DC power input. The servo drives come with built-in high-capacity filters for the power input. There are terminals as well as soldering holes (soldering contacts) for connecting power supply lines in a vibration-resistant way.

The power supply terminals are polarity sensitive.

It is recommended to twist “+” and “-” wires into a twisted pair.

Power Output

The SC-60 servo drives can provide power to external modules such as encoders using +5.0V and GND output pins as well as via dedicated soldering holes (soldering contacts).

The nominal output current is 0.150 A at 5.0V.

The output power lines are protected by fuses set at 0.300 A. The fuses are reset by power-cycling the servo drive.

Mounting

Suggested bolts are DIN912 M2.5 or DIN84 M2.5.

EMC/EMI Management

The servo drives cause electromagnetic emissions that interfere with nearby systems (EMI/EMC), while at the same time are susceptible to external electromagnetic noise too.

The motor phase wires are a major source of electromagnetic emissions due to the servo drive's PWM voltage modulation scheme that uses square pulses. The square pulses generate many harmonics that cause electromagnetic emissions through the motor phase wires acting as antennae.

Below are recommendations on improving EMI/EMC characteristics of the system:

- Twist differential signal wires (CAN, SSI, BISS-C) to improve electromagnetic noise immunity for digital signals.
- Twist “-“ and “+” input DC power wires at intervals of 100mm. Use shorter power wires, whenever possible.
- In challenging EMI/EMC environments, consider using shielded twisted DC power cable and installing ferrite ring filters on the power wires in the shield's gap. Connect the shield of the cable to a ground at the power supply/battery side.
- When multiple servo drives are used in the same system with the same power supply or a battery, it is important to arrange a proper single ground connection (“earth”) where all servo drives are connected to through their “ground” (“-”) terminals.
- The shields of the shielded cables should be grounded to “earth”.
- Do not twist or bundle brushless motor's phase wires.
- Use shorter motor phase cables, whenever possible. Consider using shielded (but not twisted in this case) motor phase cables and installing ferrite ring filters on the motor phase wires in the shield's gaps to attenuate the harmonics. Connect the cable shield to a ground (“earth”) point at the motor end.
- The servo drive's PWM switching frequency can be increased or decreased through firmware configuration, so that the switching frequency itself and its harmonics do not fall into application frequency range of payloads or communication systems.



*Servo actuators designed around Servosila SC-series
Servo Drives*

YouTube: <http://www.youtube.com/user/servosila>

www.servosila.com/en/motion-control

www.servosila.com/en/shop