



BLDC Motor Controller

CG-2033-B-50

CG-2033-B-50E

Operations Manual



Controller used with Brushless DC Motor only (CG-2033-B-25)

Operating Specifications/Features:

Supply voltage required: 100 - 240 VAC

AC Power Inlet Fuse: 5 Amp 250 VAC, (5x20mm)

Speed range 35 - 500 rpms (+/- 1.5 RPM's)

Clockwise and Counterclockwise rotation

Display RPM or Torque

User allowable acceleration rates

Two communication ports for pc control and data logging, a 9-pin RS232 port and a mini-USB port.

Operating Instructions:

- 1- Attach the motor plugs (6 pin and 4 pin) to the motor receptacles located on the bottom of the controller. Align keyway in plug with key on receptacle, insert and tighten threaded ring(See Figure 1 and Figure 2).
- 2- Connect the Power cord to the controller and to a grounded power outlet.
- 3- Turn the power switch located on the bottom right side of unit to "ON".
- 4- The display will show either "StoP", if the Run/Stop switch is in the Stop position, or "SoFF" (for "Safe Off") if the Run/Stop switch is in the Run position. To get the stirrer to operate, set the Run/Stop switch to the Stop position (display changes to "StoP"), then switch to the Run position. {The reason for the "SoFF" message is for safety concerns, so that the stirrer will not start at the moment the controller is turned on}.
- 5- Switch the Speed/Torque switch to the Speed position.
- 6- Select the desired motor direction either Clockwise (CW) or Counterclockwise (CCW).
- 7- Turn the speed control knob clockwise until the desired speed (RPM's) is shown on the display.
- 8- To display the torque, press the Speed/Torque switch to the Torque position.
- 9- The small slide switch on the underside of the controller is used to set the communications port (See Figure 1). When set to the right (towards the power cord), the USB port is selected for communications. When set to the left, the RS232 port is selected for communications.



Figure 1 (Bottom of Controller)

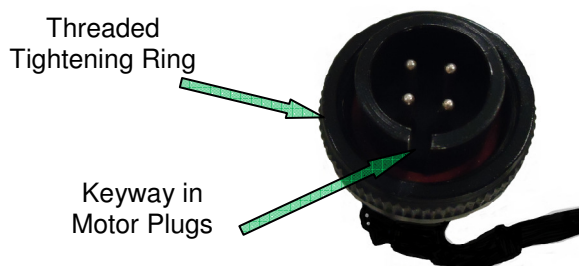


Figure 2 (Motor Plug Connector)

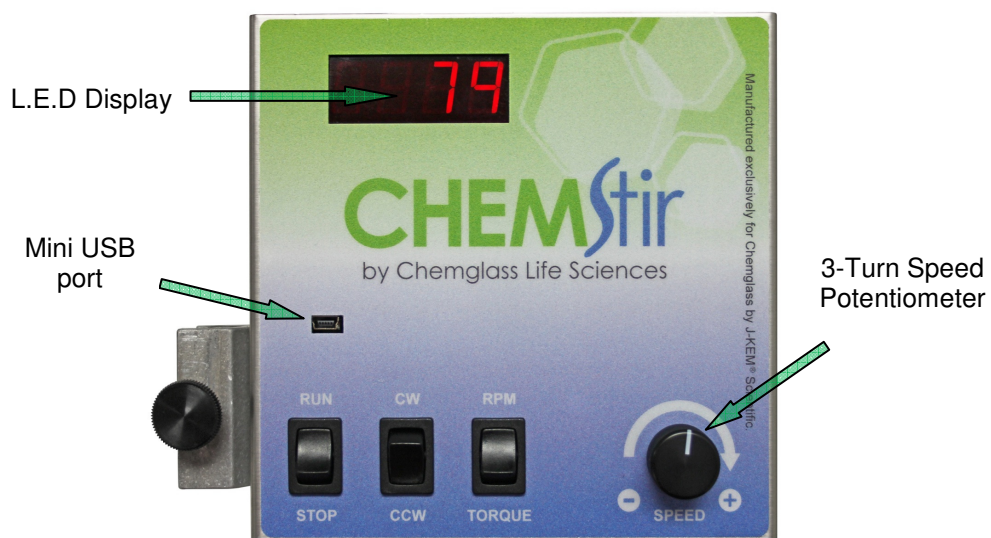


Figure 3 (Front of Controller)

BLDC Motor Controller ASCII Protocol

Display Messages:

Display	Description
StOP	The controller is stopped by hardware. The “Run/Stop” switch is in the “Stop” position. This hardware control has the highest priority and takes precedence over the speed control knob and PC control.
off	The motor speed is set to 0. The “Run/Stop” switch is in the “Run” position and the “Speed” knob is in the off position (fully counter clockwise position).
Poff	The controller is under PC control and the external controller set the speed to 0 RPM.
Soff	This is a “safe off” state and the motor’s RPM is 0. This message is displayed under two conditions. 1- When the controller is powered up, the “Run/Stop” switch is set to the “Run” position. Set the Run/Stop switch to the Stop position to clear this message. 2- The controller was under PC control when the user issued the “RM” (release motor) command while the “speed” knob was set to a rotational speed greater than 0. Set the Run/Stop switch to the Stop position to clear this message.
35 - 500	The display is showing the actual motor speed in RPMs AND the “Torque/RPM” switch is in the RPM position.
0 - 400	The display is showing the actual motor torque in [oz-in] AND the “Torque/RPM” switch is in the torque position.
P35 – P500	The controller is under PC control. The display is showing the actual motor speed in RPMs AND the “Torque/RPM” switch is in the RPM position.
P0 – P400	The controller is under PC control. The display is showing the actual motor torque in [oz-in] AND the “Torque/RPM” switch is in the torque position.
o-Ld	Current is being delivered to the motor at the maximum allowable value. The controller shows this message when it cannot reach the requested speed (RPM) using the maximum allowable motor current. During an overload condition, the controller reduces the motor’s stirring speed until it reaches a speed that does not exceed the allowable maximum current limit. The controller has two current limits. A hard coded limit of 13.2 amps which cannot be exceeded under any circumstance. A user programmable limit that can be set to any value less than 13.2 amps. This is useful in cases where, for safety reasons, the user wants to limit the maximum torque generated by the motor.
StAL	The controller shows this message when: <ul style="list-style-type: none"> - The motor’s shaft is stalled. - Excessive motor current consumption. - Short circuit in the motor, motor’s cable, or motor’s connector. - The electric motor is unplugged from the BLDC controller. - One of the two connectors from the motor to the controller are unplugged. - Approx. 3 seconds elapsed with no shaft rotation was detected. <p>To reset this error state, toggle the “Run/Stop” switch to clear the error. If the problem persists, the message will appear again.</p>
FLt	The power MOSFET driver is reporting a fault condition. This message is shown when: <ul style="list-style-type: none"> - Under-voltage or over-voltage is detected in the power stage. - Over temperature is detected in the power stage. <p>Toggle the “Run/Stop” switch to clear this error state. If the problem persists, the message will appear again.</p>
bPot	The speed control knob is not working properly. The controller shows this message when: <ul style="list-style-type: none"> - The potentiometer is defective - There’s an open connection between the potentiometer and the control board.

Communication Interface

The Brushless DC Motor Controller has two communication ports, a 9-pin RS232 port and a mini-USB port.

The USB port communicates with the PC using a virtual comm port driver included with your controller's software or from J-KEM's web site.

Default communication parameters are 9600 baud, 8 data bits, no parity, 1 stop bit, and no hardware handshaking. The end-of-line character is a carriage return <CR>, or Hex 13. Do not add a linefeed to the end of line.

The pin out of the 9-pin connector is:

Pin number on the controller	Pin number on a 9-pin PC port
2 (Rcv)	3 (Xmit)
3 (Xmit)	2 (Rcv)
5 (Gnd)	5 (Gnd)

Protocol Syntax

Commands are case sensitive and must be in upper case.

Query Format: <COMMAND><CR>

This example queries the motors sensed torque.

Example: Command = TQ<CR>

Reply = TQ###.#<CR> Where ### is the sensed torque on the motor.

Command Format: < COMMAND ><Value><CR>

This example sets the motors rotational speed.

Example: Command = SS350<CR>

Reply = SS350<CR>

Commands With Storable Parameters Format: < COMMAND >!<CR>

Some commands have the option of storing the current value of the parameter to non-volatile memory.

The saved value for this parameter is recalled and used anytime the controller is powered up.

The parameter's value can be changed during a run, and the new value will be used as long as power is applied to the controller, but if the new value is not saved to memory, then on subsequent startups, the last saved value is recalled and used.

To store a parameter's value to non-volatile memory, first set the desired value for the parameter of interest, then second, issue the SAVE command, as shown in the example below.

This sequence of commands save the Quick Stop feature to a state of "1" (or ON).

Command - QS1<CR> Reply = QS1<CR>

Command - QS!<CR> Reply = QS!<CR>

If an invalid command is issued or a value is sent that is out of range for the parameter being addressed, the reply is: BadCmd<CR>

< COMMAND > is a two bytes command, upper case letters only.

<Value> is a floating point or unsigned integer value. See each particular command for the acceptable range.

<CR> stand for "Carriage Return".

Command Options:

‘Q’ indicates that a query command is allowed.

‘N’ indicates that the command optionally accepts a value.

‘S’ indicates that the sent value can optionally be saved to non-volatile memory

Command	Value (range)	Command Options	Description
SS	0 (OFF) 35-500 (RUN) 1-34 (Not allowed)	Q/N	Sets/ Reads the speed of the motor in RPM. A value of zero causes the motor to stop stirring. A value in the range of 35 to 500, sets the speed of the motor to the value sent, in RPM. <u>NOTE:</u> When the speed is set by serial command, the speed knob on the front of the controller is disabled, and the letter ‘P’ is appended to the motors speed to indicate that the motor is under PC control. To disable PC control, either send the “RM” command to release PC control of the motor, or turn power off to the controller.
SA	40-500	Q/N/S	Sets/ Reads the controllers acceleration in [RPM/sec^2] After power on, the default value is 100 [RPM/sec^2], unless a user set value was previously stored. The user can save a new default value for acceleration. The default value when the controller was shipped is 100.
TQ	None	Q	Returns the actual torque in [oz-in.] sensed by the motor. <u>NOTE:</u> Even when the motor is running with no load, the torque value of the motor is not zero, a minimum torque is always present which represents the torque needed to operate the motor and gearbox under no-load conditions.
CU	None	Q	Returns the actual motor current consumption in [Amperes]
VL	None	Q	Returns the actual voltage applied to the motor in [Volts DC]
QS	0-1	Q/N/S	Sets/Reads the controller’s Quick Stop setting. Quick Stop is a feature that determines how the motor decelerates when commanded to stop, either by a PC command, or by the front panel Stop/Run switch. When QS is set to a value of 1, anytime the motor is commanded to stop, it decelerates at a high rate, causing the motor to stop within 1 second. When set to a value of 0, and the motor is commanded to stop, the motor decelerates according to the value set by the acceleration command (SA). Generally, a deceleration rate of 100, or lower, causes a very smooth deceleration of the motor. On startup, quick stop recalls the last saved value to memory. The default value when the controller is shipped is 0.
RM	None	N	This command releases the controller from the PC or external control. See “SS” command for more information. <u>NOTE:</u> If the controller is under PC control and the user sends the “RM” command while the “speed” knob is active (35-500 RPM), the motor quickly stops and the BLDC controller switches to the “safe off” state.
PI	None	Q	This command returns a string with product information similar to this: <i>OHS v1.3-041416 SN_#####</i> , where ##### is the controller’s serial number. The exact string depends on the date of manufacturing.

MS	0	Q/N	<p>This command returns the controller's current status. Where: MS0 = Controller ready MS1 = Motor stopped ("Run/Stop" switch in "Stop" pos.) MS2 = Motor accelerating MS3 = Motor decelerating MS4 = Motor running at set RPM MS5 = Controller is in "safe off" state MS6 = Motor overloaded MS7 = Motor stalled MS8 = MOSFET driver fault condition detected MS9 = Defective speed potentiometer detected</p> <p>When the controller shows an error state, the state can be reset by sending the command "MS0". If the error condition still persists, the error status will be set to reflect the existing error state.</p> <p>See "display messages" for more detail.</p>
BR	0-5	Q/N/S	<p>This command sets/reads the baud rate of the serial port. Where: BR0 = 2400 bps BR1 = 4800 bps BR2 = 9600 bps BR3 = 19200 bps BR4 = 38400 bps BR5 = 57600 bps</p> <p><u>NOTE:</u> Changing the baud rate is a three step process. First – the new baud rate must be sent in using the BR command. Second – the new baud rate must be saved to memory using the BR! command. Third – the controller must be powered off, then powered back on before the new baud rate will take effect. The default value when the controller is shipped is 2, or 9600 baud.</p>
UC	50-900	Q/N/S	<p>Sets the maximum current the motor can pull before an over current limit is declared. Motor current is measured and stored as an integer value in units of "counts". To convert from counts to amps of current the conversion factor is: 1 count = 0.0146667 amps.</p> <p>Current Limit = (counts) * 0.0146667</p> <p>Example: Current Limit = 600 * 0.014667 = 8.8 amps The controller has a hard coded maximum limit of 900 counts, (13.2 amps). The factory default value is 900.</p>
IC	None	Q	<p>Queries the instantaneous current being delivered to the motor. Units are in digital counts. To convert from digital counts to amps, multiply the returned value by 0.0146667.</p>
PC	None	Q	<p>Queries the peak current delivered to the motor since being powered up. Units are in digital counts. To convert from digital counts to amps, multiply the returned value by 0.0146667.</p>
RC	None	Q	<p>Resets the peak current value recorded by the controller since being powered up to 0.</p>
FD	None	Q	<p>Resets the controller to factory default values. These values are: Quick Stop = 0, of Off Acceleration is 100., Baud rate = 9600, User current limit = 900</p>
SN	None	Q	<p>Returns the serial number of the controller.</p>

Chemglass Life Sciences, Warranty and Limitation of Liability

Warranty:

Chemglass, Inc. guarantees this unit against defects in material and workmanship for a period of one year from the date of purchase. If the unit should malfunction, it must be returned for evaluation. If the unit is determined to have a defect in materials or workmanship, then it will be repaired or replaced at no charge. Tampering with the unit or damage resulting from excessive current, heat, moisture, vibration, corrosive materials, or misuse will void this warranty. Programming changes or reconfigurations are not covered under warranty. CGLS shall not be responsible to the original purchaser or any other party or parties for bodily or property loss, damages, or injuries of any kind or nature through either direct or indirect use of the product.

Return Authorization:

CGLS must authorize any return of product. Please contact a customer service representative via the correspondence listed below to obtain a Return Merchandise Authorization (RMA) number. The purchaser is responsible for all packing and shipping to CGLS. If the equipment or material came in contact or was proximate to any biological organism, toxic or corrosive material, or any agent reasonably deemed to be potentially harmful, it must be cleaned and decontaminated prior to receipt by CGLS. The purchaser is obligated to disclose fully in writing, the cleaning and decontamination method. We reserve the right not to accept any unauthorized or potentially harmful shipment.

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