RoboteQ

FDCG3260

4th Generation Triple Channel 60A Brushed DC Motor Controller with USB and CAN

RoboteQ's FDCG3260T is a feature-packed, high-current, triple channel drive for brushed DC motors. It is a direct replacement for the company's popular FDC3260, using a 4th generation processor and implementing many performance, algorithmic, and other qualitative enhancements. The motors may be operated in open, closed loop speed mode, position mode or in torque mode. Advanced control features such as acceleration/velocity feedforward, cascaded control modes operation, and a 16 kHz current loop update rate provide fast and precise motion control in speed, torque, and position modes.

The FDCG3260T offers a range of analog, pulse, and digital I/Os that can be configured for various functions, such as command or feedback inputs and limit switches. It accepts input commands from multiple sources, including RC radios, analog joysticks, wireless modems, PLCs, or microcomputers. For mobile robot applications, the drive's three motor channels can be operated independently or mixed to provide movement and steering capabilities. Additionally, up to 127 controllers can be networked via CAN bus, with communication speeds reaching up to 1 Mbit/s on a single twisted pair.

Numerous safety features are incorporated into the drive, including Safe Torque Off (STO). The drive's operation can be extensively automated and customized using microBasic Language scripts. The drive can be configured, monitored and tuned in real-time using a RoboteQ's free PC utility. The drive can also be reprogrammed in the field with the latest features by downloading new operating software from Roboteq's website.

Applications

- Motion simulators
- XYZ platforms
- Underwater Robotic Vehicles
- Stabilization Gimbals
- Machine tools
- Industrial automation
- Telepresence Systems
- Animatronics

Key Features

- USB, RS232, RS485, 0-5V Analog, or Pulse (RC radio) command modes
- CAN bus interface up to 1Mbit/s with multiple protocol support
- Auto switch between Serial, USB, CAN, Analog, or Pulse based on user-defined priority
- Built-in dual 3-phase high-power drivers for three brushed DC motor at up to 60A each
- Support for NTC temperature sensors through analog inputs (requires an external pull-up resistor)
- Full forward & reverse motor control. Four quadrant operation.
- Operates from a single 14V-60V power source
- STO- Safe Torque Off support (T-version) - Certification pending
- Programmable current limit up to 60A per motor for protecting controller, motor, wiring and battery
- Dedicated connector for two quadrature encoders
- Up to eight Analog Inputs for use as command and/or feedback
- Up to eight 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
- Four general purpose 24V, 1.5A open collector outputs for brake release or accessories
- Selectable min, max, center and dead band in Pulse and Analog modes

- Trigger action if Analog, Pulse or Encoder counter capture are outside user selectable range (soft limit switches)
- Open loop or closed loop speed control operation
- Closed loop position control with encoder, analog or pulse/ frequency feedback
- Torque mode
- PID control loop
- Feedforward control
- Cascaded Torque, Speed, Position PID loops.
- High performance 16KHz current loop
- 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 2.0 mOhm ON resistance MOSFETs
- Selectable triggered action if Amps is outside user- selected range
- I2T protection
- 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 0.25" Faston tabs
- 5.5" (139.7mm) L, 5.5" W (139.7mm), 1.0" (25mm) H
- -10° to +70° C operating environment
- 1 lbs (500g)
- Easy configuration, tuning and monitor 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	Ethernet	STO
FDCG3260T	3	60	60	No	Yes
FDCG3260TE	3	60	60	Yes	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

Power Wires Identifications and Connection

Power connections are made by means of Faston tabs located at the back of the controller.

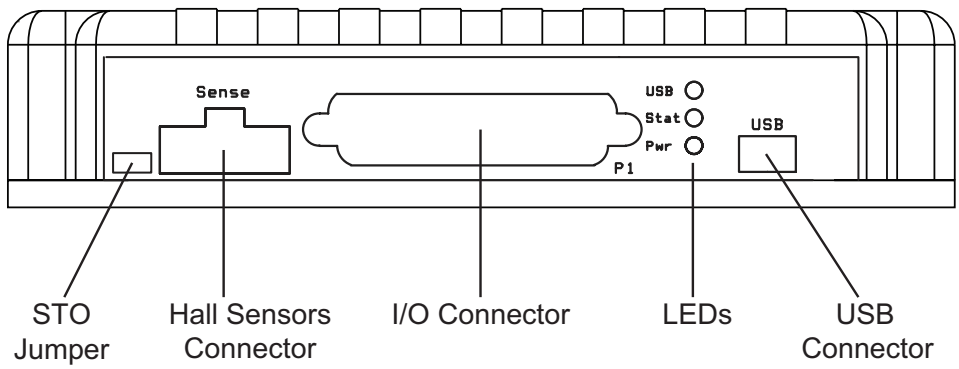


FIGURE 1. FDCG3260T Front View

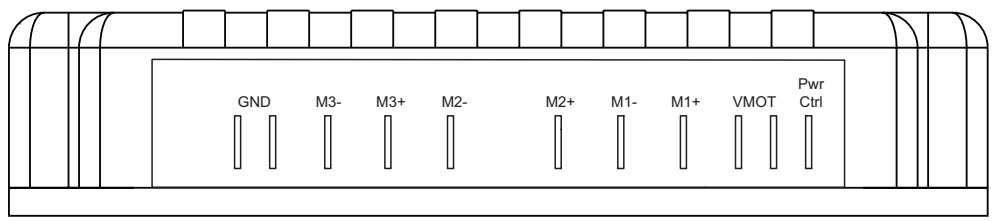


FIGURE 2. FDCG3260T Rear View

Figure 3, below, shows how to wire the controller and how to turn power On and Off.

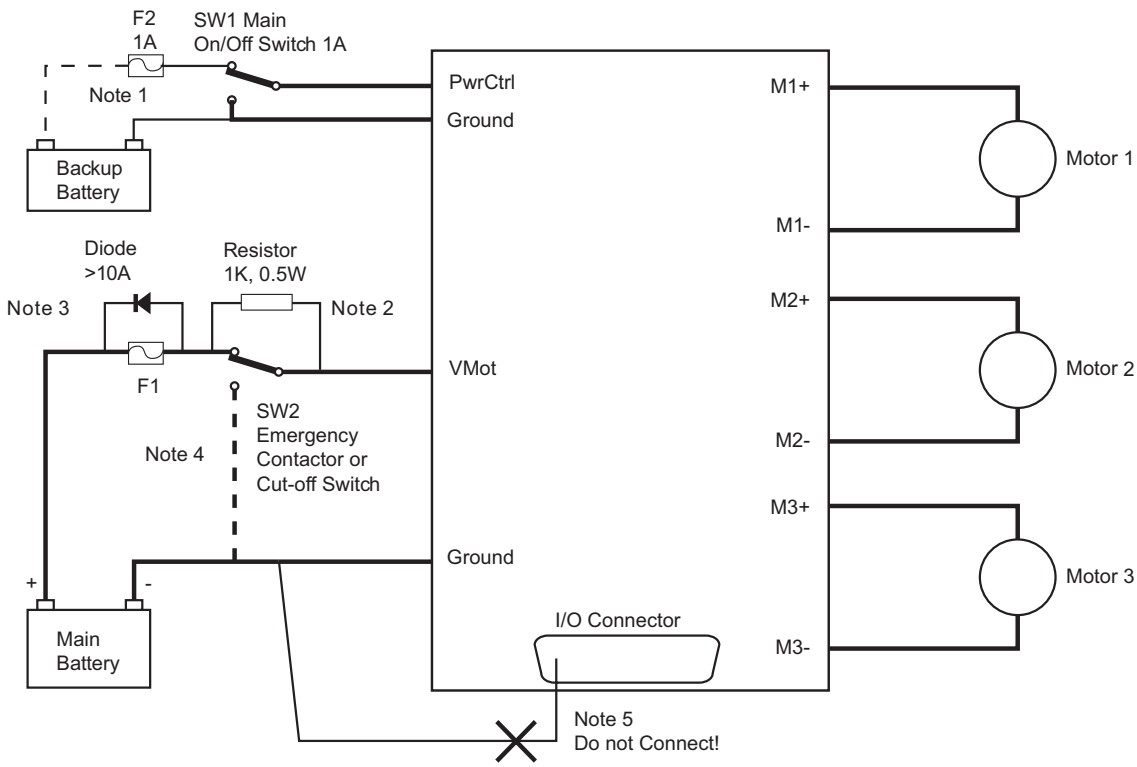


FIGURE 3. Powering the Controller. Thick lines identify MANDATORY connections

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 drive is connected as shown Figure 3. All connections shown as thick black lines line are mandatory. The controller must be powered On/Off using switch SW1on the PwrCtrl tab. Use a suitable high-current fuse F1.

Precharge Resistor

The controller has 2350uF of 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 or the contactor, insert a precharge resistors as shown in figure 3. For precharging to take place, the controller must be turned off by grounding the Power Control pin.

Enable Safe Torque Off

Note 3: When STO is enabled (STO jumper removed), 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.

Regeneration Protection and Braking

During rapid deceleration, the kinetic energy will cause regenerative current to flow out of the motor and back to the power source. When using a battery, this current will recharge the battery and create a dynamic braking effect. When a power supply is used, the current will not be able to flow back to the source. Without a return path, the regenerative current can cause the voltage to rise to a dangerous level for the electronics.

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.

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.

Emergency Switch or Contactor

The battery must be connected Permanently to the controller's Vmot tabs 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.

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.

EMI/EMC

All cables, including motor, battery, and control cables, should be kept shorter than 3 meters to minimize EMI/EMC issues. Depending on the source of interference and the cable type, the use of external filters or ferrite chokes may be necessary.

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.

Encoder Connection

Connection to the Encoders is done using a special connector on the front side of the controller. The connector is a 10-pin Molex Microfit 3.0, ref. 43025-1000. Pin assignments are in Table 1, below.

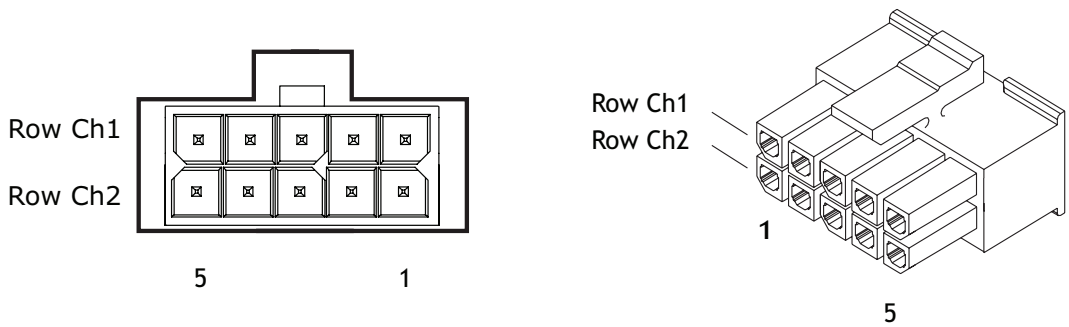


FIGURE 4. Encoder Connector

TABLE 1.

Pin Number	1	2	3	4	5
Row Ch1	Ground	ENC1 A	Enc1 B		5V
Row Ch2	Ground	ENC2 A	Enc2 B		5V

Warning

Encoder 3 input and pulse inputs share pins, as indicated in the pin assignment. Additionally, Encoder 1 and Encoder 2 inputs share pins internally with pulse inputs 5 to 8. If both encoder and pulse inputs are enabled, the encoder will have higher priority. For any modifications involving the use of these shared pins, the drive should be in Open Loop mode, an emergency stop should be activated, and the system must be in a safe position. This precaution is necessary because changing the usage can result in false input readings and unintended motor movement.

Important Note

Hardware revisions prior to 2.1 have a maximum supported sensor frequency of 1.6 kHz.

Connection to SSI Absolute Encoder

RoboG4 DC products support pure binary encoding (no Gray code, offset binary, etc.) SSI sensors in single-turn version, with a resolution of up to 16 bits. These SSI sensors must be connected to the 10-pin Molex connector, which is also used for Encoder sensors. The specific sensor connected to the Molex connector can be determined through the controller's configuration settings. The controller employs differential signals for both clock and data. While data signals are separate for each channel, the clock signal is common to both. Therefore, for dual-channel operation, both sensors should be connected to the 'Clock -' and 'Clock +' pins. Please note that the SSI sensor is supported only on channel 1 and channel 2. The Molex connector pin assignment for the SSI sensor is shown in Table 2.

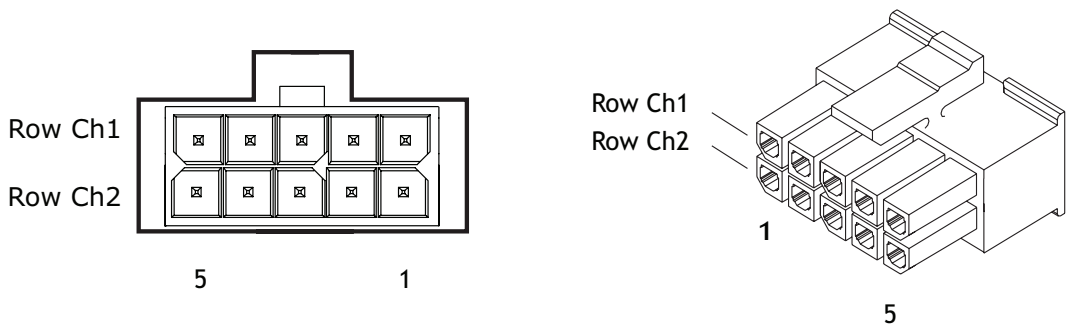


FIGURE 5. SSI Connector

TABLE 2.

Pin Number	1	2	3	4	5
Row 1	Ground	Data 1 –	Data 2 –	CLK –	5V
Row 2	Ground	Data 1 +	Data 2 +	CLK +	5V

Commands and I/O Connections

Connection to RC Radio, Microcomputer, Joystick and other low current sensors and actuators is done via the DB25 connector. The functions of many pins vary depending on controller model and user configuration. Pin assignments are found in the table below.

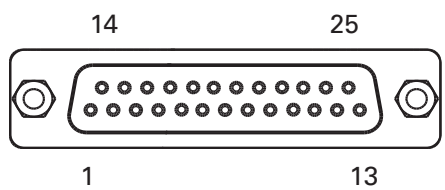


FIGURE 6. Main Connector Pin Locations

TABLE 3.

Connector Pin	Power	Dout	STO	Com	Pulse	Ana	Dinput	Enc
1	GND							
14	5VOut							
2				RS TxD				
15			STO 1 (1)		RC1 (2)	ANA1	DIN1	
3				RS RxD				
16			STO 2 (1)		RC2 (2)	ANA2	DIN2	
4					RC3	ANA3	DIN3	
17					RC4 (3)	ANA4	DIN4	
5	GND							
18		DOUT1						
6		DOUT2						
19		DOUT3						
7		DOUT4						
20				CANH				
8				CANL				
21					RC5	ANA5	DIN5	
9							DIN9	
22					RC6	ANA6	DIN6	
10							DIN10	
23				RS485 +				
11				RS485 –				
24					RC7	ANA7	DIN7	ENC3A
12					RC8	ANA8	DIN8	ENC3B
25	5VOut							
13	GND							

Note 1: STO jumper must be removed for STO signals to be active. See STO section for details.

Note 2: Not compatible with multi-PWM.

Note 3: Input 4 has a large capacitance which may degrade the Pulse signal. Prefer any of the other pulse inputs.

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 ANA1 and Pot 2 to ANA4. 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.

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 FDCG3260T'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 4. 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-.

Ethernet Communication

The FDCG3260TE version supports all the controller's serial commands over a TCP/IP connection. Modbus TCP protocols are also supported in that version.

Important Note

TCP Mode and CAN Mode cannot work in conjunction on "E" type controllers; only one can be active at a time. By default, TCP Mode is enabled and CAN Mode is disabled, allowing for a plug & play TCP connection. To switch to CANOpen, the user must manually disable TCP Mode and enable CAN Mode. To revert to Ethernet, TCP Mode must be enabled and CAN Mode disabled by the user.

Status LED Flashing Patterns

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 2 seconds interval. The flashing pattern provides operating or exception status information.

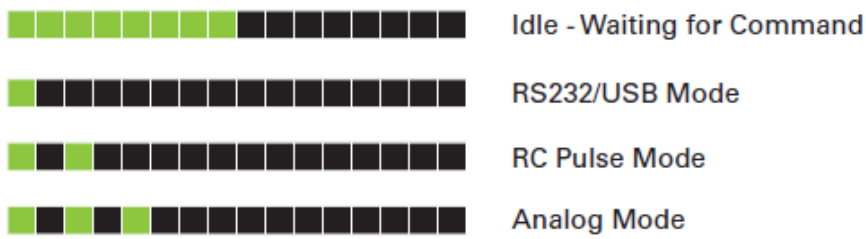


FIGURE 7. Normal Operation Flashing Patterns

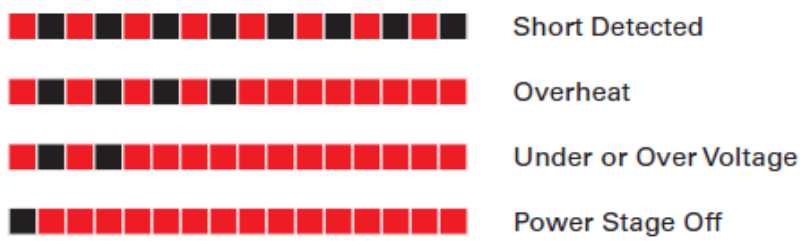


FIGURE 8. Exception or Fault Flashing Patterns

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

The communication LED gives status information on the CAN and USB.

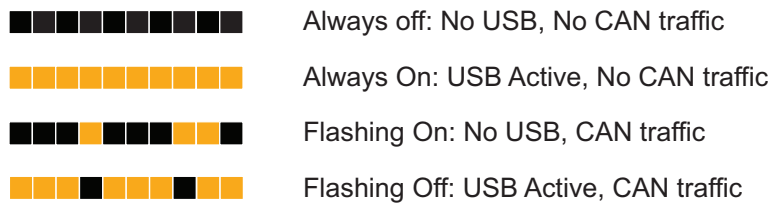


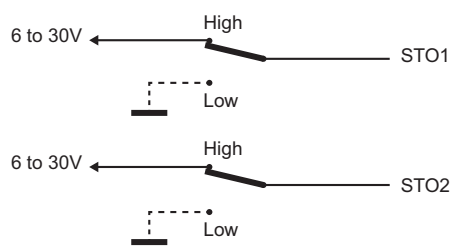
FIGURE 9. Communication LED Flashing Patterns

Safe Torque Off - STO (Certification Pending)

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 11 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.

Secure Connection to AMP FASTON™ Tabs

Power Motor and Battery connections are made via standard 250mils (6.35mm) AMP FASTON Tabs. FASTON connectors provide a high current and very secure connection, proven over decades of use in the automotive industry. For maximum current handling, use connectors for AWG8 wires.

FASTON connectors have an extremely tight fit and will not come off on their own. It is recommended, nevertheless, that the wiring is made so that the cables are never pulling the connector outward.

Frequent disconnects and reconnects will eventually loosen the connector's grip on the tab. If frequent disconnection is required, consider using Positive Lock connectors from TE Connectivity or their equivalent. These connectors have a spring-loaded tab latch pin that will lock into the hole of the male tab.

Electrical Specifications

Absolute Maximum Values

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

TABLE 5.

Parameter	Measure point	Min	Typical	Max	Units
Battery Leads Voltage	Ground to Vmot			63 (1)	Volts
Reverse Voltage on Battery Leads	Ground to Vmot	-1			Volts
Power Control Voltage	Ground to Pwr Control wire			63	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 DB25			30	Volts
Encoder inputs voltage	Ground to Encoder inputs of Molex connector			5.5	Volts
RS232 I/O pins Voltage	External voltage applied to Rx/Tx pins			30 (2)	Volts
Note 1: Maximum regeneration voltage in normal operation. 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 6.

Parameter	Measure point	Model	Min	Typ	Max	Units
Input Voltage	Ground to Vmot	All	0 (1)		60	Volts
Input continuous Max Current	Power source current	All			80	Amps
Output Voltage	Ground to U, V, W wires	All	0 (1)		60	Volts
Power Control Voltage	Ground to Power Control wire	All	0 (1)		60	Volts
Minimum Operating Voltage	VBat or PwrCtrl wires	All	14 (2)			Volts
Over Voltage protection range	Ground to Vmot	All	5		60 (3)	Volts
Under Voltage protection range	Ground to Vmot	All	0		50 (3)	Volts
Idle Current Consumption	Vmot or PwrCtrl wires	All	50	100 (4)	150	mA
ON Resistance (Excluding wire resistance)	Vmot to U, V or W. Ground to U, V or W			2.5		mOhm
Max Current for 30s	Motor current				60	Amps
Continuous Max Current per channel	Motor current				40 (5)	Amps
Current Limit range	Motor current		10	50 (6)	60	Amps
Stall Detection Amps range	Motor current		10	60 (6)	60	Amps
Stall Detection timeout range	Motor current	All	1	500 (8)	65000	msec
Short Circuit Detection threshold (8)	Between Motor wires or Between Motor wires and ground or Between Motor wires and Vmot No Protection. Permanent damage will occur				72 (9)	Amps
Short Circuit Detection Threshold	Between Motor wires and VBat					
Power cable thickness	Power input and output	All		8		AWG

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

Note 2: Minimum voltage must be present on VBat or Power Control wire

Note 3: Factory default value. Adjustable in 0.1V increments

Note 4: Current consumption is lower when higher voltage is applied to the controller's VBat or PwrCtrl wires

Note 5: Estimate. Limited by case temperature. Current may be higher with better cooling

Note 6: Factory default value. Adjustable in 0.1A increments

Note 7: Factory default value. Time in ms that Stall current must be exceeded for detection

Note 8: Controller will stop until zero command given in case of short circuit detection

Note 9: RMS value

Command, I/O and Sensor Signals Specifications

TABLE 7.

Parameter	Measure point	Min	Typ	Max	Units
Main 5V Output Voltage	Ground to 5V pins on	4.6	4.9	5.2	Volts
5V Output Current	5V pins on RJ45 and DSub15			200 (1)	mA
Digital Output Voltage	Ground to Output pins			30	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	Amps
Input Impedances (except DIN11-19)	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
Encoder Frequency	-			200	kHz
SSI clock frequency (2)	SSI clock pin			680	kHz
Pulse durations	Pulse inputs	20000		10	us
Pulse repeat rate	Pulse inputs	50		250	Hz
Pulse Capture Resolution	Pulse inputs		1		us
Frequency Capture	Pulse inputs	100		1000	Hz
Minimum Pulse on or Pulse off duration	Pulse inputs	25			us
Note 1: Sum of all 5VOut outputs Note 2: The "First Clock Delay" function is not supported.					

Operating & Timing Specifications

TABLE 8.

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
Current Loop update rate	Internal		16000		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					

Scripting

TABLE 9.

Parameter	Measure Point	Min	Typ	Max	Units
Scripting Flash Memory	Internal		32K		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 10.

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			70	Watts
Thermal resistance	Power MOSFETs to case			0.8	°C/W
Humidity	Case			93 (5)	%
Ambient temperature	Ambient	-10		70	°C
Storage temperature	Ambient	-20		80	°C
Pollution Degree	-	PD 2 (6)			
Fast fuse to install	(3)	60		2 x 60	Amps
Overload motor protection	-	Check note 4			

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: For operating only one channel install 60A fuse and for operating all channels 2 x 60A fuse should be installed. Power source must be capable to blow the fuse instantly in case of short circuit. There are two power terminal tabs. Fuse should be installed in both of them for safety.

Note 4: Current limiting mechanism available through firmware. External overload motor protection can be used if required (provided by user)

Note 5: Non-Condensing

Note 6: The product was evaluated for use in and under the provisions for installation in a Pollution Degree 2 environment.

STO Specifications

TABLE 11.

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 12.

Parameter	Measure Point	Min	Typ	Max	Units
Weight	Board		500 (1)		g (lbs)
Power Connectors width	Terminal tab		0.25		Inches
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		

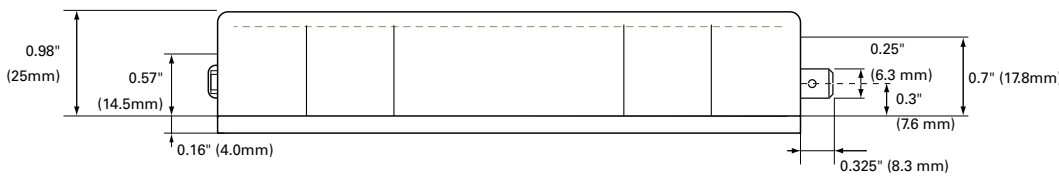


FIGURE 11. FDCG3260T Side View and Dimensions

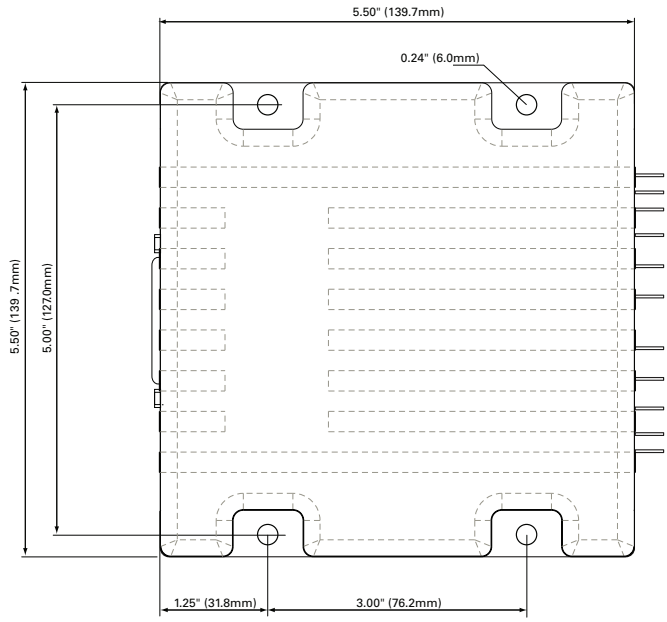


FIGURE 12. Top View and Dimmensions