RoboteQ Drive's 3.0 Firmware

Release Notes

Iss:1/Rev.:0

V2.1a, May 30, 2023. Visit www.roboteq.com to download the latest revision of this manual
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Table of Contents

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Introduction

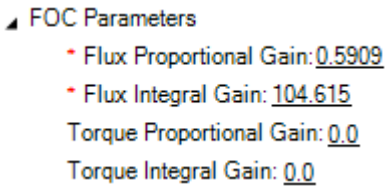
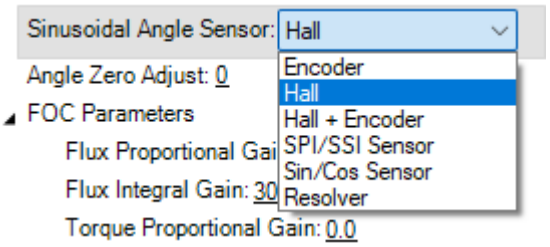
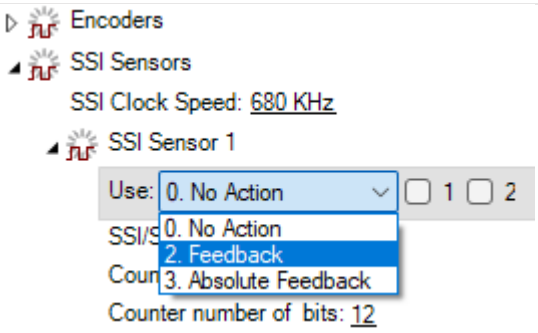
Firmware v3.0 has been validated and released for use with the new generation of RoboG4 drives. The RoboG4 products are the successors to the non-G models, offering the same dimensions, power specifications, and connections to enable a seamless transition. RoboG4 drives retain all the features of the previous generation and introduce advanced features that, when enabled, can enhance application performance.

Important Note

Make sure you use the latest Roborun+ PC Utility (v3.0 or newer) when configuring and operating drives running firmware 3.0. The latest released version can be downloaded from Roboteq's website.

List of Features

Operational Features

Sinusoidal Commutation with Field Oriented Control (FOC): Allows for precise and efficient motor control with reduced torque ripple by synchronizing the stator and rotor fields. It is enabled by configuring the FOC Flux and Torque gains.	
Support for Multiple Sensors for Motor Commutation: Compatible with a variety of sensors including Hall, Encoder, SSI, Sin/Cos, and Resolver, enabling flexible motor control setups.	
Support for Multiple Sensors for Motor Feedback: Extends flexibility in feedback systems, accommodating Hall, Encoder, SSI, Sin/Cos, Resolver, analog, and pulse sensors.	

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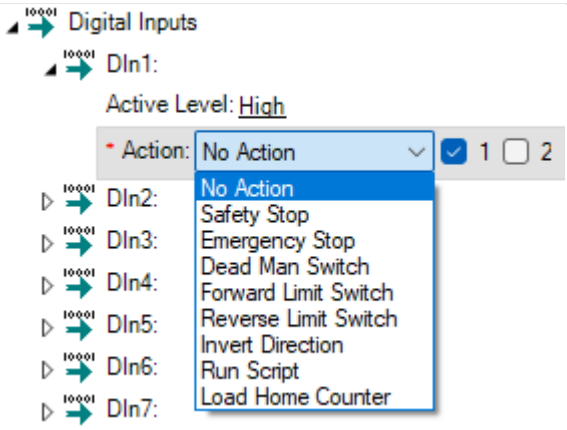
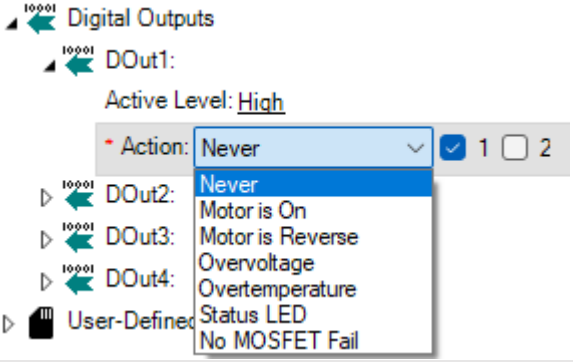
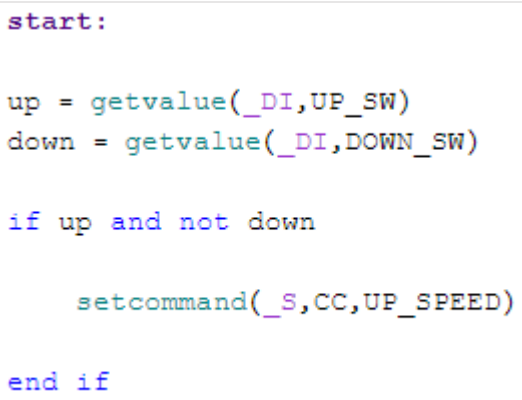
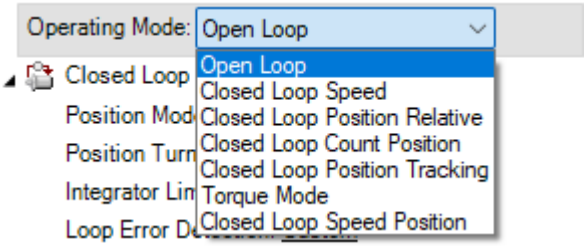
Multifunctional Inputs: Offers versatile input options that can be configured for various control tasks and signals, including digital, analog and pulse functions.	
Configurable digital output action: Digital outputs can implement functions that serve status LEDs and critical fault indicators.	
Customizable Scripting Language: Provides the ability to tailor functions to specific applications through easy-to-use native scripting. MicroBasic language enables control over the drive's I/Os, runtime variables, and allows modification of the drive's configuration during operation.	
Various Control Modes: Includes Open Loop, Speed, Position, and Torque modes to suit a wide range of motor control requirements.	
Cascaded Control Modes: Three control loops—Torque, Speed, and Position—each with its own PI gains, operate in a cascaded manner, allowing for optimal motor control. Cascade operation is enabled by setting the FOC Torque gains.	

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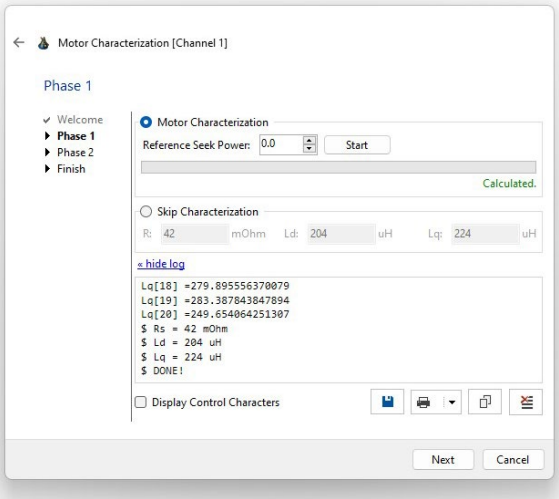
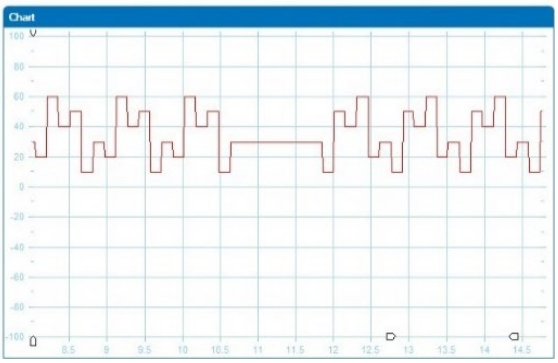
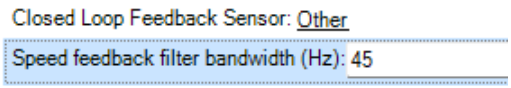
Automatic Motor Characterization: Automatically estimates the motor's RL specifications that are necessary for tuning the FOC loop to optimize current control and sinusoidal commutation.



Motor/Sensor Calibration Process: An automatic calibration process aligns the zero position of the sensor with the motor. This process ensures that precise sensor placement is not required for operation. The motor/sensor setup should be completed at least once for each different motor.



Configurable Low Pass Filter for Speed Control: Enhances control stability and performance by filtering out high-frequency noise.



16 kHz Current Loop (New Feature): Having a 16 times faster control loop than before allows for the ultimate control of the motor current even at most demanding command or load changes.

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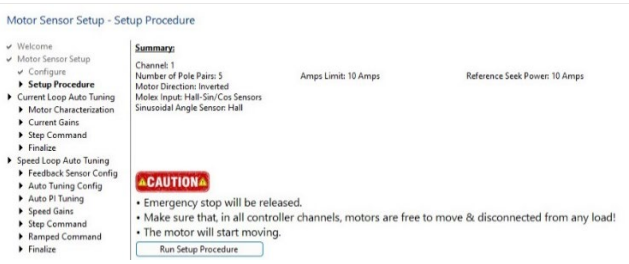
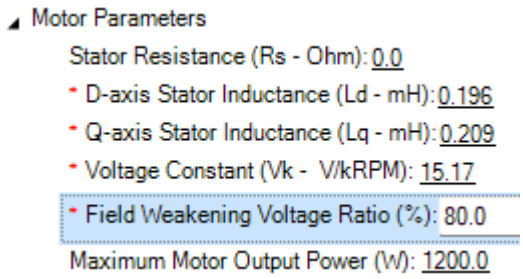
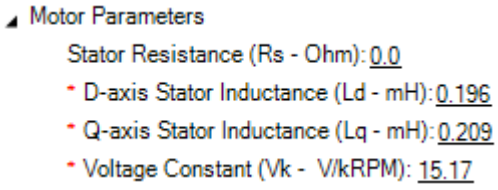
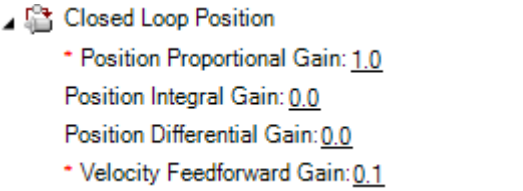
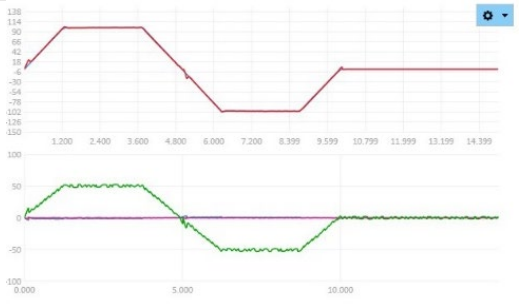
Motor Configuration Wizard (New Feature): Guides users through motor setup with an intuitive step-by-step process.	
Automatic Field Weakening (New Feature): Enhances high-speed motor performance by automatically reducing field magnetization when the requested speed surpasses the motor's nominal range. Automatic field weakening is enabled by reducing the maximum allowed voltage ratio.	
Current Decoupling Terms (New Feature): Improves motor control precision by separating torque-producing current from magnetizing current. Decoupling control is automatically enabled when D-axis, Q-axis and Voltage Constant parameters are both set.	
Feedforward Control (New Feature): Improves response times and control accuracy by preemptively compensating for the system's inertia. Feedforward control is enabled by setting the system's inertia and friction coefficients. In position mode is enabled by setting The Velocity Feedforward gain.	
Automatic PID Load Tuning (New Feature): This feature automatically computes the system's inertia and the coefficients of rotating friction to enable the prediction of optimal closed-loop PID gains. It is a part of the Motor Sensor and Tuning Setup Wizard.	

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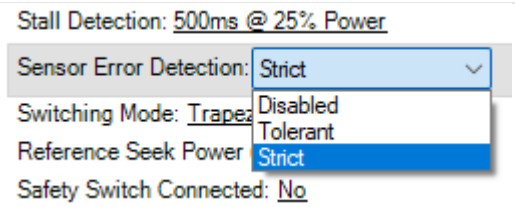
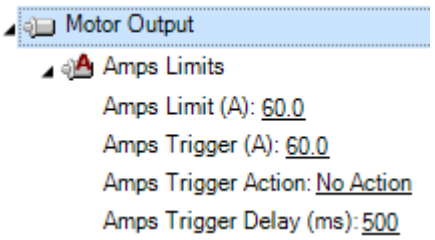
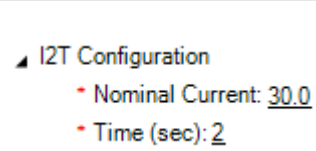
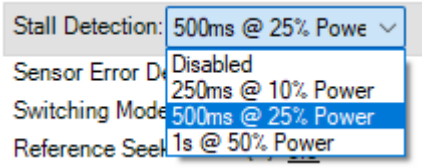
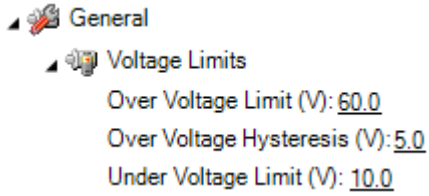
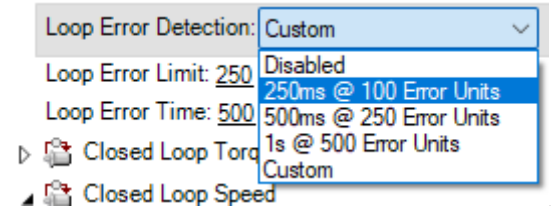
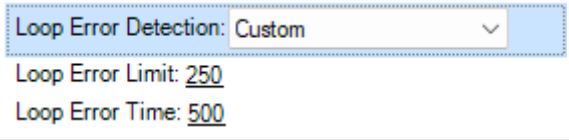
Protections and Safety Features

Sensor Error Detection: The drive continuously checks for sensor-related errors during operation, applicable for Hall sensors, Hall+Encoder combinations, Sin/Cos sensors, and Resolvers. The detection level is configurable.	
Amps Limiting function: The drive can limit the maximum motor current, with the allowable value set by the user's Amp Limit, in conjunction with the I2T configuration and the Max Power setting. **Amps Trigger Function:** This protection will trigger an error if the motor current exceeds a permissible value for longer than the defined time.	
I2T protection: This feature safeguards the motor from thermal overload by monitoring the integral of the current squared over time (I^2T), preventing damage due to excessive current draw over a period. It allows for brief current surges but limits long-term overcurrent conditions.	
Stall detection: An error is triggered if there is no change in the sensor signals for a defined amount of time and at a minimum PWM duty cycle.	
Overvoltage/Undervoltage Detection: The power stage is disabled if the DC bus voltage gets out of the permissible limits.	
Loop Error Detection: An error is triggered when the Loop Error runtime value surpasses a predefined threshold for a specified duration, allowing for the detection of load variations or mechanical faults.	
Customizable Loop Error Detection (New Feature): The specific Loop Error duration and level are fully customizable in 3.0+ firmware	

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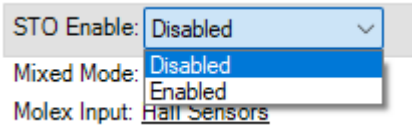
Short circuit detection: The drive immediately disables the power stage if the measured motor current exceeds 120% of the drive's maximum current rating, protecting against potential damage from short circuits.	**- Not Configurabe -**
MOSfail detection: The drive checks the health of the MOSFETs at every startup and when a specific command is issued. If a failed MOSFET is detected, the H-bridge is disabled.	**- Not Configurabe -**
STO-Certified Function: STO-certified circuitry prevents the motor from generating any additional torque when the STO is triggered. The motor will continue to rotate with the existing torque until it is stopped by the friction of the mechanical parts.	

Important Note

For additional information regarding Operational Features and Protections, refer to the latest Roboteq Drives User Manual.

Important Note

To configure a RoboG4 drive from scratch, please refer to the latest Roborun+ Utility User Manual (v3.0), the latest Roboteq Drives User Manual, and the relevant Quick Startup and Configuration Guides.

References

Please refer to the below table for the documentation and support resources related to RoboG4 products.

Table 1: References

Document	Source
Roborun+ 3.0 latest User Manual	https://www.roboteq.com/support/documentation-download
Roboteq Drives 3.0 latest User Manual	https://www.roboteq.com/support/documentation-download
Roborun+ 3.0 latest software update	https://www.roboteq.com/support/files-download
Latest v3.0 Firmware	https://www.roboteq.com/support/files-download
Quick Startup and Configuration guides	https://roboteq.freshdesk.com/en/support/solutions/folders/70000481967

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