

ExoNaut Robot Library

This guide shows every function available in the ExoNaut library.

Space Trek ExoNaut Programming Reference

Created by Ryan Bori

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1 Basic Setup

Every ExoNaut program starts with this basic setup:

```
#include "ExoNaut.h"
exonaut robot;

void setup() {
    robot.begin(); // Always start with this!
}
```

2 ExoNaut (Main Robot Control)

2.1 Motor Functions

```
robot.begin() // Initialize the robot
robot.set_motor_speed(m1, m2) // Set motor speeds (-100 to 100)
robot.encoder_motor_set_speed(motorid, speed) // Set individual motor speed
robot.encoder_motor_get_speed(items[]) // Get current motor speeds
robot.stop_motor(motorid) // Stop motor (0=both, 1=left, 2=right)
robot.encoder_motor_turn(speed, angle) // Turn robot by degrees
```

2.2 Encoder Functions

```
robot.reset_encoder_counter(motorid) // Reset wheel counters
robot.get_encoder_count(items[]) // Get wheel rotation counts
robot.set_motor_type(motortype) // Set motor type (1 or 2)
```

2.3 LED Functions

```
robot.setColor(n, r, g, b) // Set individual LED color (0-5)
robot.setColorAll(r, g, b) // Set all LEDs same color
robot.show() // Update LED display
robot.clear() // Turn off all LEDs
```

3 ExoNaut_AICam (AI Camera)

3.1 Setup Functions

```
camera.begin() // Initialize camera
camera.changeFunc(new_func) // Change camera mode
camera.updateResult() // Get new camera data
camera.setLed(state) // Turn camera LED on/off
camera.currentFunc() // Get current camera mode
```

3.2 Face Detection Functions

```
camera.anyFaceDetected() // Check if any face found
camera.numOfTotalFaceDetected() // Count total faces
camera.anyLearnedFaceDetected() // Check for known faces
camera.numOfTotalLearnedFaceDetected() // Count known faces
camera.anyUnlearnedFaceDetected() // Check for unknown faces
camera.numOfTotalUnlearnedFaceDetected() // Count unknown faces
```

```
camera.faceOfIdDetected(id)           // Check for specific face ID
camera.getFaceOfId(id, result)         // Get face data by ID
camera.getFaceOfIndex(index, result)   // Get face data by position
camera.printFaceTable()                // Print all face info
```

3.3 Object Detection Functions

```
camera.anyObjDetected()                // Check if any object found
camera.numOfObjDetected()              // Count objects detected
camera.objIdDetected(id)               // Check for specific object
camera.numOfObjIdDetected(id)          // Count specific objects
camera.objDetected(id, index, result)  // Get object data
```

3.4 Color Detection Functions

```
camera.anyColorDetected()              // Check if any color found
camera.numOfColorDetected()            // Count colors detected
camera.colorIdDetected(id)             // Check for specific color
camera.colorId(id, result)             // Get color data
```

3.5 Line Detection Functions

```
camera.anyLineDetected()               // Check if line found
camera.numOfLineDetected()             // Count lines detected
camera.lineIdDetected(id)              // Check for specific line
camera.lineId(id, result)              // Get line data
```

3.6 QR Code Functions

```
camera.qrCodeDetected()                // Check if QR code found
camera.qrCodeDataLength()              // Get QR code data length
camera.qrCodeData(buffer)              // Get QR code text
```

3.7 Barcode Functions

```
camera.barCodeDetected()               // Check if barcode found
camera.barCodeDataLength()             // Get barcode data length
camera.barCodeData(buffer)             // Get barcode text
```

3.8 AprilTag Functions

```
camera.anyTagDetected()                // Check if AprilTag found
camera.numOfTotalTagDetected()          // Count AprilTags
camera.tagIdDetected(id)               // Check for specific tag
camera.numOfTagIdDetected(id)          // Count specific tags
camera.tagId(id, index, result)         // Get tag data
camera.printAllTagDetails()            // Print all tag info
camera.getTagInfo(tagId, result)        // Get specific tag info
camera.estimateTagDistance(tag, realSize) // Calculate distance to tag
camera.getTagOrientation(tag)           // Get tag rotation
camera.listDetectedTagIds()            // List all tag IDs
```

3.9 Classification Functions

```
camera.classIdOfMaxProb()           // Get most likely class ID
camera.classMaxProb()               // Get highest probability
camera.classProbOfId(id)            // Get probability of class
```

3.10 Feature Learning Functions

```
camera.featureIdOfMaxProb()         // Get most likely feature ID
camera.featureMaxProb()             // Get highest probability
camera.featureProbOfId(id)          // Get probability of feature
```

3.11 Number Recognition Functions

```
camera.numberWithMaxProb()          // Get most likely number
camera.numberMaxProb()              // Get highest probability
camera.numberProbOfId(id)           // Get probability of number
```

3.12 Landmark Recognition Functions

```
camera.anyLandmarkDetected()        // Check if landmark found
camera.numOfLandmarksDetected()      // Count landmarks
camera.landmarkIdDetected(id)        // Check for specific landmark
camera.numOfLandmarkIdDetected(id)   // Count specific landmarks
camera.getLandmarkById(id, result)   // Get landmark data
camera.landmarkIdWithMaxProb()        // Get most likely landmark
camera.landmarkMaxProb()              // Get highest probability
camera.landmarkProbOfId(id)          // Get probability of landmark
```

4 ExoNaut_AICamLF (AI Camera Line Following)

4.1 Setup Functions

```
lineFollower.begin(robot, camera)   // Initialize line follower
lineFollower.update()                // Update line detection
lineFollower.setBaseSpeed(speed)     // Set driving speed
```

4.2 Detection Functions

```
lineFollower.getLineStatus(lineId)   // Get line status
lineFollower.getLineAngle(lineId)    // Get line angle
lineFollower.getLineOffset(lineId)    // Get line offset from center
lineFollower.getLineData(lineId, data) // Get complete line data
lineFollower.isLineDetected(lineId)   // Check if line detected
lineFollower.getLineCount()           // Count lines detected
```

4.3 Movement Functions

```
lineFollower.followLine(lineId, speed, turnFactor) // Manual line following
lineFollower.simpleFollowLine()                     // Automatic line following
```

5 ExoNaut_Ultrasonic (Distance Sensor)

5.1 Measurement Functions

```
sensor.getDistance()           // Get distance in millimeters
```

5.2 LED Functions

```
sensor.color(r1, g1, b1, r2, g2, b2)    // Set LED colors (0-255)
sensor.breathing(r1, g1, b1, r2, g2, b2) // Set breathing effect
sensor.getColor()                      // Get current LED colors
sensor.getBrightness()                 // Get LED brightness
sensor.getLEDMode()                    // Get LED mode
```

6 ExoNaut_TempHumid (Temperature & Humidity)

6.1 Setup Functions

```
weather.begin()                // Initialize sensor
weather.isConnected()           // Check if sensor connected
```

6.2 Reading Functions

```
weather.readSensor()            // Take new measurement
weather.temperature              // Temperature in Fahrenheit
weather.temperatureC             // Temperature in Celsius
weather.humidity                 // Humidity percentage
weather.getStatus()              // Get sensor status
weather.debugSensor()           // Print debug information
```

7 ExoNaut_MP3 (Music Player)

7.1 Setup Functions

```
music.begin()                   // Initialize MP3 player
```

7.2 Playback Functions

```
music.play()                    // Play current song
music.pause()                   // Pause playback
music.next()                     // Next song
music.previous()                 // Previous song
```

7.3 Volume Functions

```
music.volumeUp()                // Increase volume
music.volumeDown()              // Decrease volume
music.maxVolume()               // Set maximum volume
music.mute()                     // Mute sound
music.setVolumePercent(percent) // Set volume 0-100\%
```

8 ExoNaut_7Segment (Number Display)

8.1 Setup Functions

```
display.begin()           // Initialize display
display.setBrightness(level) // Set brightness 0-7
```

8.2 Display Functions

```
display.showNumber(number) // Show number 0-9999
display.showText(text)     // Show text (4 letters max)
display.clear()            // Clear display
display.showDigit(digit, position) // Show single digit
display.clearDigit(position) // Clear single position
display.showDecimal(number, decimalPlace) // Show number with decimal
```

8.3 Animation Functions

```
display.countUp(start, end, delayMs) // Count up animation
display.countDown(start, end, delayMs) // Count down animation
display.blink(number, times, delayMs) // Blink number
display.scroll(text, delayMs) // Scroll long text
```

9 ExoNaut_DotMatrix (Dot Display)

9.1 Setup Functions

```
matrix.begin()           // Initialize display
matrix.setBrightness(level) // Set brightness 0-7
```

9.2 Display Functions

```
matrix.clear()           // Clear display
matrix.setAllOn()        // Turn all dots on
matrix.setAllOff()       // Turn all dots off
matrix.setLED(row, col, state) // Set individual dot
matrix.setRow(row, pattern) // Set entire row
matrix.setMatrix(data[]) // Set entire display
```

9.3 Text Functions

```
matrix.displayNumber(number) // Show number 0-99
matrix.displayNumberWithEffect(number) // Show number with animation
matrix.drawChar(character, x, y) // Draw single character
matrix.scrollText(text, numScrolls, speed) // Scroll text across
matrix.stopScroll() // Stop scrolling
matrix.isScrolling() // Check if scrolling
matrix.updateScroll() // Update scroll (call in loop)
```


10 ExoNaut_Knob (Dial Control)

10.1 Setup Functions

```
knob.begin(port)           // Initialize knob on port 1,2,6,8
knob.setCalibration(rawMin, rawMax) // Set custom range
```

10.2 Reading Functions

```
knob.getPercent()          // Get position 0-100%
```

11 ExoNaut_IMU (Motion Sensor)

11.1 Setup Functions

```
motion.start()             // Initialize sensor
motion.calibrate()          // Calibrate (keep still!)
motion.update()             // Get new readings
```

11.2 Orientation Functions

```
motion.getPitch()          // Get pitch angle
motion.getRoll()           // Get roll angle
motion.getYaw()            // Get yaw angle
```

11.3 Motion Functions

```
motion.getAccelX()          // Get X acceleration
motion.getAccelY()          // Get Y acceleration
motion.getAccelZ()          // Get Z acceleration
motion.getGyroX()           // Get X rotation rate
motion.getGyroY()           // Get Y rotation rate
motion.getGyroZ()           // Get Z rotation rate
motion.isShaking(threshold) // Check if shaking
```

12 ExoNaut_LineFollower (Simple Line Sensor)

12.1 Reading Functions

```
lineSensor.readLineFollower(value) // Read all sensors
lineSensor.CH1                     // Sensor 1 state (true/false)
lineSensor.CH2                     // Sensor 2 state
lineSensor.CH3                     // Sensor 3 state
lineSensor.CH4                     // Sensor 4 state
```

13 ExoNaut_RGB_LED (External LED Strip)

13.1 Setup Functions

```
RGB myStrip(numLeds, pin, rmtChannel)    // Create LED strip
myStrip.begin()                          // Initialize strip
myStrip.setBrightness(level)             // Set brightness 0-255
```

13.2 LED Functions

```
myStrip.setColor(n, r, g, b)             // Set LED color
myStrip.setColor(n, packedColor)         // Set LED with packed color
myStrip.show()                           // Update strip display
myStrip.clear()                           // Turn off all LEDs
myStrip.numPixels()                       // Get number of LEDs
```

14 Quick Reference

14.1 Camera Application Modes

```
APPLICATION_FACEDETECT    // Face detection
APPLICATION_OBJDETECT      // Object detection
APPLICATION_COLORDETECT    // Color detection
APPLICATION_LINEFOLLOW     // Line detection
APPLICATION_QRCODE         // QR code reading
APPLICATION_BARCODE        // Barcode reading
APPLICATION_APRILTAG       // AprilTag detection
APPLICATION_CLASSIFICATION // Image classification
APPLICATION_FEATURELEARNING // Feature learning
APPLICATION_NUMBER_REC     // Number recognition
APPLICATION_LANDMARK       // Landmark recognition
```

14.2 Common Object IDs

- **1** = Aeroplane, **2** = Bicycle, **3** = Bird, **4** = Boat
- **5** = Bottle, **6** = Bus, **7** = Car, **8** = Cat
- **9** = Chair, **10** = Cow, **15** = Person, **16** = Plant

14.3 Motor IDs

- **0** = Both motors
- **1** = Left motor
- **2** = Right motor

14.4 Port Compatibility

Which modules work on which ports:

- **RGB LED Strip:** Ports 6, 8
- **Temperature & Humidity:** Ports 3, 4, 5, 9

- **7-Segment Display:** Ports 6, 8
- **Dot Matrix Display:** Ports 6, 8
- **IMU (Motion Sensor):** Ports 3, 4, 5, 9
- **Avoid Obstacle Sensor:** Ports 6, 8
- **Knob (Dial):** Ports 1, 2, 6, 8
- **Fan:** Ports 6, 8
- **MP3 Player:** Ports 3, 4, 5, 9
- **AI Camera:** Ports 3, 4, 5, 9

14.5 Port Pin Mappings

Pin connections for each port:

- **Port 1:** DIN = Pin 36, CLK = Pin 39
- **Port 2:** DIN = Pin 32, CLK = Pin 35
- **Port 6:** DIN = Pin 33, CLK = Pin 25
- **Port 8:** DIN = Pin 26, CLK = Pin 27