

# Rover CAN protocol

v0.9.0

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## List of messages

CAN ID	Message Name	DLC	Description
0x100	Steering	5	Set steering servo position
0x101	Throttle	5	Set throttle value
0x200	Battery Cell Voltages	7	Report individual cell voltages
0x201	Battery Regulated Output	8	Report regulated power output voltage and current
0x202	Battery Output	8	Report battery output voltage and current
0x203	Servo Voltage	2	Report steering servo operating voltage
0x204	Servo Current	2	Report steering servo current usage
0x205	Battery Voltage	2	Report the battery voltage
0x210	Wheel Front Left Speed	8	Reports the front left wheel speed
0x211	Wheel Front Right Speed	8	Reports the front right wheel speed
0x212	Wheel Rear Left Speed	8	Reports the rear left wheel speed
0x213	Wheel Rear Right Speed	8	Reports the rear right wheel speed
0x214	Obstacle Detector Front Distance	8	Reports the front obstacle detector distances
0x215	Obstacle Detector Rear Distance	8	Reports the rear obstacle detector distances
0x300	Battery Jumper Config	1	Set battery current measurement jumper config
0x301	Battery Regulated Output Voltage	4	Set the regulated power output voltage
0x302	Battery Output ON/OFF	2	Set the main power and regulated power states
0x303	Battery Report Frequency	2	Set battery report frequency
0x304	Battery Low Voltage Cutoff	8	Configure low-voltage cutoff parameters

0x305	Servo Set Voltage	2	Set steering servo operating voltage
0x306	Servo PWM Config	2	Set servo PWM settings
0x307	Servo Report Frequency	2	Set servo report frequency
0x308	Motor PWM Config	2	Set motor controller PWM settings
0x309	Servo Reverse Direction	0	Reverse steering servo direction
0x30A	Motor Reverse Direction	0	Reverse motor throttle direction
0x30B	Servo Failsafe	5	Configure steering servo failsafe settings
0x30C	Motor Failsafe	5	Configure motor failsafe settings
0x30D	Steering Subtrim	2	Configure steering servo subtrim
0x30E	Throttle Subtrim	2	Configure throttle subtrim
0x30F	Battery main power overcurrent threshold	4	Set overcurrent threshold for main power output
0x310	Battery regulated output overcurrent threshold	4	Set overcurrent threshold for regulated power output
0x500	AD Battery Cell Voltages	7	Report individual cell voltages
0x501	AD Battery Regulated Output	8	Report regulated power output voltage and current
0x502	AD Battery Output	8	Report battery output voltage and current
0x600	AD Battery Jumper Config	1	Set battery current measurement jumper config
0x601	AD Battery Regulated Output Voltage	4	Set the regulated power output voltage
0x602	AD Battery Output ON/OFF	2	Set the main power and regulated power states
0x603	AD Battery Report Frequency	2	Set battery report frequency
0x604	AD Battery Low Voltage Cutoff	8	Configure low-voltage cutoff parameters
0x60F	AD Battery main power overcurrent threshold	4	Set overcurrent threshold for main power output
0x610	AD Battery regulated output overcurrent threshold	4	Set overcurrent threshold for regulated power output

# Control messages

These messages are used to drive the Rover.

## Steering

Control the steering servo position. ID 0x100, DLC 5 bytes.

Byte number	Values	Description
0	0 OR 1	Set to 0 for pulse-width steering mode, 1 for angle steering mode.
<b>Pulse-width steering mode</b>		
Byte number	Values	Description
1-2	500 - 2500	Sets the steering servo position using pulse width in microseconds. Interpreted as an unsigned 16-bit integer.
3-4	0	Ignored.
<b>Angle steering mode</b>		
Byte number	Values	Description
1-4	-90 - 90	Sets the steering servo position using an angle value in degrees. The bytes are interpreted as a 32-bit float.

## Throttle

Set the throttle value at the ESC. ID 0x101, DLC 5 bytes.

Byte number	Values	Description
0	0	Set to 0 for pulse-width mode.
1-2	1000 - 2000	<p>Throttle pulse-width in microseconds. Unsigned 16 bit integer.</p> <p>1000µs is full brake/full reverse  1500µs is neutral position  2000µs is full throttle</p> <p><b>NOTE:</b> on some motor controllers the values are reversed, i.e. 1000µs is full throttle. Verify before using by looking at the CAN bus while using the RC.</p>

		To reverse, the rover must be fully stopped then put in the neutral position. Then, wait at least 250 ms, before sending a reverse pulse.
Byte 3-4	0	Ignored.

## Status messages

These messages are available to read the status of the Rover.

### Battery Cell Voltages

Report the individual cell voltages of the connected battery. ID 0x200, DLC 7 Bytes.  
Message is sent twice, once with the values of cells 1-3 and once with the values of cells 4-6.

Byte number	Values	Description
0	0 OR 1	Cell group 0 (Cells 1, 2, 3) or 1 (Cells 4, 5, 6).
1-2	Voltage in mV	Cell 1 or Cell 4 voltage, depending on the value of byte 0. Unsigned 16-bit integer.
3-4	Voltage in mV	Cell 2 or Cell 5 voltage, depending on the value of byte 0. Unsigned 16-bit integer.
5-6	Voltage in mV	Cell 3 or Cell 6 voltage, depending on the value of byte 0. Unsigned 16-bit integer.

### Battery Regulated Output

Report the voltage and current of the regulated power output. ID 0x201, DLC 8 Bytes.

Byte number	Values	Description
0-3	Voltage in mV	Output voltage in mV. Unsigned 32-bit integer.
4-7	Current in mA	Output current in mA. Unsigned 32-bit integer.

### Battery Output

Report the voltage and current of the main power output. ID 0x202, DLC 8 Bytes.

Byte number	Values	Description
0-3	Voltage in mV	Output voltage in mV. Unsigned 32-bit integer.
4-7	Current in mA	Output current in mA. Unsigned 32-bit integer.

### Servo Voltage

Report the servo operating voltage. ID 0x203, DLC 2 bytes.

Byte number	Values	Description
0-1	Voltage in mV	Servo voltage in mV. Unsigned 16-bit integer.

## Servo Current

Report the servo current usage. ID 0x204, DLC 2 bytes.

Byte number	Values	Description
0-1	Current in mA	Servo current usage in mA. Unsigned 16-bit integer.

## Battery Voltage

Report the battery voltage as seen from the steering servo. ID 0x205, DLC 2 bytes.

Byte number	Values	Description
0-1	Voltage in mV	Battery voltage in mV. Unsigned 16-bit integer.

## Front Left Wheel Speed

Reports the front left wheel speed. ID 0x210, DLC 8 bytes.

Byte number	Values	Description
0-3	Varies	Wheel speed in RPM. Signed 32-bit integer.
4-7	Varies	Wheel speed in km/h. Signed 32-bit integer.

## Front Right Wheel Speed

Reports the front right wheel speed. ID 0x210, DLC 8 bytes.

Byte number	Values	Description
0-3	Varies	Wheel speed in RPM. Signed 32-bit integer.
4-7	Varies	Wheel speed in km/h. Signed 32-bit integer.



## Rear Left Wheel Speed

Reports the rear left wheel speed. ID 0x210, DLC 8 bytes.

Byte number	Values	Description
0-3	Varies	Wheel speed in RPM. Signed 32-bit integer.
4-7	Varies	Wheel speed in km/h. Signed 32-bit integer.

## Rear Right Wheel Speed

Reports the rear right wheel speed. ID 0x210, DLC 8 bytes.

Byte number	Values	Description
0-3	Varies	Wheel speed in RPM. Signed 32-bit integer.
4-7	Varies	Wheel speed in km/h. Signed 32-bit integer.

## Obstacle Detector Front Distance

Reports the front obstacle detector distances. ID 0x214, DLC 8 bytes.

Byte number	Values	Description
0-1	20-5000	Distance measured by the left sensor in mm.
2-3	20-5000	Distance measured by the mid-left sensor in mm.
4-5	20-5000	Distance measured by the mid-right sensor in mm.
6-7	20-5000	Distance measured by the right sensor in mm.

## Obstacle Detector Rear Distance

Reports the rear obstacle detector distances. ID 0x215, DLC 8 bytes.

Byte number	Values	Description
0-1	20-5000	Distance measured by the left sensor in mm.
2-3	20-5000	Distance measured by the mid-left sensor in mm.
4-5	20-5000	Distance measured by the mid-right sensor in mm.

6-7	20-5000	Distance measured by the right sensor in mm.
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## AD Battery Cell Voltages

Report the individual cell voltages of the connected battery. ID 0x500, DLC 7 Bytes.  
 Message is sent twice, once with the values of cells 1-3 and once with the values of cells 4-6.

Byte number	Values	Description
0	0 OR 1	Cell group 0 (Cells 1, 2, 3) or 1 (Cells 4, 5, 6).
1-2	Voltage in mV	Cell 1 or Cell 4 voltage, depending on the value of byte 0. Unsigned 16-bit integer.
3-4	Voltage in mV	Cell 2 or Cell 5 voltage, depending on the value of byte 0. Unsigned 16-bit integer.
5-6	Voltage in mV	Cell 3 or Cell 6 voltage, depending on the value of byte 0. Unsigned 16-bit integer.

## AD Battery Regulated Output

Report the voltage and current of the regulated power output. ID 0x501, DLC 8 Bytes.

Byte number	Values	Description
0-3	Voltage in mV	Output voltage in mV. Unsigned 32-bit integer.
4-7	Current in mA	Output current in mA. Unsigned 32-bit integer.

## AD Battery Output

Report the voltage and current of the main power output. ID 0x502, DLC 8 Bytes.

Byte number	Values	Description
0-3	Voltage in mV	Output voltage in mV. Unsigned 32-bit integer.
4-7	Current in mA	Output current in mA. Unsigned 32-bit integer.

## Configuration messages

The Rover comes with sane default settings, but if needed the settings can be changed using the configuration messages below.

### Battery Jumper Config

Set the power board's current jumper configuration. ID 0x300, DLC 1 byte.

Byte number	Values	Description
0	0-3	X11 and X12 headers jumper configuration. 0 = X11 OFF, X12 OFF 1 = X11 ON, X12 OFF 2 = X11 OFF, X12 ON 3 = X11 ON, X12 ON

### Battery Regulated Output Voltage

Set the target output voltage for the regulated power output. ID 0x301, DLC 4 bytes. Power board will try to get as close as possible to the given voltage. WARNING: make sure to measure the voltage and verify it's correct before connecting anything to the output. Otherwise you may damage the connected components.

Byte number	Values	Description
0-3	Voltage in mV	Regulated output voltage in mV. Unsigned 32-bit integer.  The Regulated output voltage range depends on the JP1 jumper configuration on the board.  If JP1 is set to 5V, the range is 3-6V. If JP1 is set to 12V, the range is 6-16V.

### Battery Output ON/OFF

Set the battery output state for the main power and the regulated power outputs. ID 0x302, DLC 2 bytes.

Byte number	Values	Description
0	0 or 1	Main power output state. 0 is OFF, 1 is ON. Note that turning the main power off will also turn the regulated power off.
1	0 or 1	Regulated power output state. 0 is OFF, 1 is ON.

## Battery Report Frequency

Set the servo board report and measure frequencies. ID 0x303, DLC 4 bytes.

Byte number	Values	Description
0-1	ms	Reporting period in ms, i.e. how often to send measurements over CAN. Unsigned 16-bit integer. Setting to 0 ignores this value.

## Battery Low Voltage Cutoff

Configures the low-voltage cutoff parameters. ID 0x304, DLC 8 bytes. Two cutoff voltages are configured, one for a low load condition and one for a high load condition. When any connected cell is below the cutoff voltage, main power is turned off to protect the battery.

Byte number	Values	Description
0-1	Voltage in mV	Cutoff voltage for the low load condition. Unsigned 16-bit integer.
2-3	Voltage in mV	Cutoff voltage for the high load condition. Unsigned 16-bit integer.  This value must be lower than the low load condition cutoff voltage.
4-7	Current in mA	High load threshold current. If the current draw is higher than this value, the power board will use the high load cutoff voltage.

## Servo Set Voltage

Set the servo operating voltage. ID 0x305, DLC 2 bytes. Servo board will try to get as close as possible to the given voltage. **WARNING:** check the servo voltage ratings before setting this value, as setting a too high value might damage the servo.

Byte number	Values	Description
0-1	Voltage in mV	Servo voltage in mV. Unsigned 16-bit integer.

## Servo PWM Config

Set the steering servo PWM parameters. ID 0x306, DLC 2 bytes.

Byte number	Values	Description
0-1	1 - 333	PWM frequency in Hz. Unsigned 16-bit integer.

		Setting to 0 ignores this value.
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## Servo Report Frequency

Set the servo board report and measure frequencies. ID 0x307, DLC 2 bytes.

Byte number	Values	Description
0-1	ms	Reporting period in ms, i.e. how often to send measurements over CAN. Unsigned 16-bit integer. Setting to 0 ignores this value.

## Motor PWM Config

Set the ESC PWM parameters. ID 0x308, DLC 2 bytes.

Byte number	Values	Description
0-1	1 - 333	PWM frequency in Hz. Unsigned 16-bit integer. Setting to 0 ignores this value.

## Servo Reverse Direction

Reverse the steering servo control direction. ID 0x309, DLC 0 bytes.

## Motor Reverse Direction

Reverse the motor control direction. ID 0x30A, DLC 0 bytes.

## Servo Failsafe

Configure the steering servo failsafe mechanism. ID 0x30B, DLC 5 bytes.

This message configures the failsafe feature, which takes over control of the steering servo when the module does not receive any steering messages in a given period of time.

Byte number	Values	Description
0	0 OR 1	0 turns the failsafe function off, 1 turns it on.
1-2	ms	Failsafe timeout period, i.e. how many ms without steering message reception until the failsafe triggers. Defaults to 100ms.
3-4	1000-2000	Pulse width to set when failsafe triggers. Defaults to 1500µs, i.e. a neutral position.

## Motor Failsafe

Configure the motor control failsafe mechanism. ID 0x30C, DLC 5 bytes.

This message configures the failsafe feature, which takes over control of the motor when the module does not receive any steering messages in a given period of time.

Byte number	Values	Description
0	0 OR 1	0 turns the failsafe function off, 1 turns it on.
1-2	ms	Failsafe timeout period, i.e. how many ms without throttle message reception until the failsafe triggers. Defaults to 100ms.
3-4	1000-2000	Pulse width to set when failsafe triggers. Defaults to 1500µs, i.e. a neutral position.

## Steering Subtrim

Set the subtrim value (permanent offset) of the steering servo. ID 0x30D, DLC 2 bytes.

Byte number	Values	Description
0-1	-500 - 500	Steering trim pulse-width in microseconds. Signed 16-bit integer.

## Throttle Subtrim

Set the subtrim value (permanent offset) of the throttle. ID 0x30E, DLC 2 bytes.

Byte number	Values	Description
0-1	-500 - 500	Throttle trim pulse-width in microseconds. Signed 16-bit integer.

## Battery Main Power Overcurrent Threshold

Set the overcurrent threshold for the main power output. ID 0x30F, DLC 4 bytes.

Byte number	Values	Description
0-3	Current in mA	The overcurrent threshold. Unsigned 32-bit integer.  This value determines what current draw is allowed before the main power output is turned off to protect the system.

## Battery Regulated Output Overcurrent Threshold

Set the overcurrent threshold for the regulated power output. ID 0x310, DLC 4 bytes.

Byte number	Values	Description
0-3	Current in mA	The overcurrent threshold. Unsigned 32-bit integer.  This value determines what current draw is allowed before the regulated power output is turned off to protect the system.

## Front Left Wheel Parameters

Set the wheel parameters for more accurate odometry. ID 0x311, DLC 8 bytes.

Byte number	Values	Description
0-3	Cog count	Number of cogs in the wheel speed module. Unsigned 32-bit integer.
4-7	Wheel diameter in m.	Wheel outer diameter measured in meters. 32-bit float.

## Front Right Wheel Parameters

Set the wheel parameters for more accurate odometry. ID 0x311, DLC 8 bytes.

Byte number	Values	Description
0-3	Cog count	Number of cogs in the wheel speed module. Unsigned 32-bit integer.

4-7	Wheel diameter in m.	Wheel outer diameter measured in meters. 32-bit float.
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## Rear Left Wheel Parameters

Set the wheel parameters for more accurate odometry. ID 0x311, DLC 8 bytes.

Byte number	Values	Description
0-3	Cog count	Number of cogs in the wheel speed module. Unsigned 32-bit integer.
4-7	Wheel diameter in m.	Wheel outer diameter measured in meters. 32-bit float.

## Rear Right Wheel Parameters

Set the wheel parameters for more accurate odometry. ID 0x311, DLC 8 bytes.

Byte number	Values	Description
0-3	Cog count	Number of cogs in the wheel speed module. Unsigned 32-bit integer.
4-7	Wheel diameter in m.	Wheel outer diameter measured in meters. 32-bit float.

## AD Battery Jumper Config

Set the power board's current jumper configuration. ID 0x600, DLC 1 byte.

Byte number	Values	Description
0	0-3	X11 and X12 headers jumper configuration. 0 = X11 OFF, X12 OFF 1 = X11 ON, X12 OFF 2 = X11 OFF, X12 ON 3 = X11 ON, X12 ON

## AD Battery Regulated Output Voltage

Set the target output voltage for the regulated power output. ID 0x601, DLC 4 bytes. Power board will try to get as close as possible to the given voltage. WARNING: make sure to



measure the voltage and verify it's correct before connecting anything to the output. Otherwise you may damage the connected components.

Byte number	Values	Description
0-3	Voltage in mV	Regulated output voltage in mV. Unsigned 32-bit integer.  The Regulated output voltage range depends on the JP1 jumper configuration on the board.  If JP1 is set to 5V, the range is 3-6V. If JP1 is set to 12V, the range is 6-16V.

## AD Battery Output ON/OFF

Set the battery output state for the main power and the regulated power outputs. ID 0x602, DLC 2 bytes.

Byte number	Values	Description
0	0 or 1	Main power output state. 0 is OFF, 1 is ON. Note that turning the main power off will also turn the regulated power off.
1	0 or 1	Regulated power output state. 0 is OFF, 1 is ON.

## AD Battery Report Frequency

Set the servo board report and measure frequencies. ID 0x603, DLC 4 bytes.

Byte number	Values	Description
0-1	ms	Reporting period in ms, i.e. how often to send measurements over CAN. Unsigned 16-bit integer. Setting to 0 ignores this value.

## AD Battery Low Voltage Cutoff

Configures the low-voltage cutoff parameters. ID 0x604, DLC 8 bytes. Two cutoff voltages are configured, one for a low load condition and one for a high load condition. When any connected cell is below the cutoff voltage, main power is turned off to protect the battery.

Byte number	Values	Description
0-1	Voltage in mV	Cutoff voltage for the low load condition. Unsigned

		16-bit integer.
2-3	Voltage in mV	Cutoff voltage for the high load condition. Unsigned 16-bit integer.  This value must be lower than the low load condition cutoff voltage.
4-7	Current in mA	High load threshold current. If the current draw is higher than this value, the power board will use the high load cutoff voltage.

## AD Battery Main Power Overcurrent Threshold

Set the overcurrent threshold for the main power output. ID 0x60F, DLC 4 bytes.

Byte number	Values	Description
0-3	Current in mA	The overcurrent threshold. Unsigned 32-bit integer.  This value determines what current draw is allowed before the main power output is turned off to protect the system.

## AD Battery Regulated Output Overcurrent Threshold

Set the overcurrent threshold for the regulated power output. ID 0x610, DLC 4 bytes.

Byte number	Values	Description
0-3	Current in mA	The overcurrent threshold. Unsigned 32-bit integer.  This value determines what current draw is allowed before the regulated power output is turned off to protect the system.