RAYON EV 85,100,200

High performance, High power, high Ampere µEV-motor controller driver

EV-Rider

Catalog numbers: RD000215 EV Rider 85
RD000229 EV Rider 100
RD000218 EV Rider 200

DATASHEET

Redler Technologies | Atir Yeda 15, Kfar Saba 4464312 | Israel
Tel: 972-9-7672980 | www.redlertechnologies.com

Disclaimer

This documentation was accurate and reliable at the time of its release. The manufacturer may revise product specifications and/or this document at any time without specifications of the product described in this manual without notification.

Product warranty

The EV-Rider warranty is valid for 12 months from the date of shipment, unless otherwise specified. The warranty will be invalidated if the customer fails to install, operate or maintain the product in accordance with the manufacturer's instructions.

Safety

To safely operate the EV-Rider, the manufacturer's safety guidelines must be strictly followed. These guidelines serve to keep your work area safe when operating the EV Rider RD0002XX and accompanying equipment.

WARNING
Before assembling and commissioning the drive, read all product documentation.
Be sure to comply with all installation instructions and requirements.
Improper handling of products can cause personal injury and equipment damage.
The manufacturer takes no responsibility for any injury or damage caused by incorrect handling or use.

- Only qualified personnel are permitted to install, commission, and maintain this drive. A qualified person has the knowledge and permission to perform tasks such as transport, assembly, installation, and maintenance.
- Be sure all system components are connected to earth ground. Electrical safety is provided through a low-resistance earth ground connection.
- During operation the drive has electrically charged components and hot surfaces. Power cables can carry a high voltage even when the motor is not moving. To avoid the risk of personal injury or equipment damage, keep covers (of encased drives) closed during and after operation according to safety guidelines. After disconnecting the power source from the drive, wait at least 30 seconds before touching the drive.
- To avoid electric arcing and hazards to personnel and electric contacts, never disconnect or connect the product while the power source is energized.
- To prevent electrostatic damage, avoid contact with highly insulating

materials, such as plastic and synthetic materials. Place the drive on a conductive surface and ground yourself to discharge any potential build-up of static electricity.

Functional safety

CPU certified to ASIL B

CBIT (Continuous Built Inn Teats) with redundant measurement, enable or detecting of functional safety conditions

Contents

Drive Features

The EV-Rider is a motor control driver that can power up to 10kW motor, and supports velocity, and current amplifier applications.

Digital and Analog control signals enable fast response and high bandwidth of current and velocity control loops, and enables easy implementation in µEV applications.

A dedicated GUI provides automatic control loop parameters for fast application setup, load/read parameters, and a high-speed, real-time graph monitor.

Rate gyro and accelerometer are embedded in the EV-Rider electronics for stabilization and driver / road behavior. A large nonvolatile memory log the vehicle and motor parameters for maintenance and malfunction prediction. BLE (Bluetooth low energy is an optional part of EV-Rider for wireless communication

Key features

- Miniature module, high power density
- Powers motors 6-10KW, 8-15kW, 10-20KW
- 24–72, 96 VDC recommended operating voltage
- 85A_{RMS} continuous current (210 A_{RMS}, 2min. 250$_{RMS}$ 5sec)
- 135A_{RMS} continuous current (330 A_{RMS}, 2min. 420A_{RMS} 5sec)
- 200A_{RMS} continuous current (420 A_{RMS}, 2min. 520A_{RMS} 5sec)
- Sinusoidal, flux-oriented current IQ ID vector control
- Motor calibration wizard
- Motor feedback: Hall and optional incremental encoder (for extra smooth operation at low velocity)
- PID closed loop modes: Velocity, current and stepper
- Autotuning and manual tuning for PID
- Dedicated GUI, load/save parameters with real-time signal scope
- Communication: CAN bus and/or RS232
- Firmware upgrade via serial
- 3 Analog(0-5VDC),5 digital inputs, 3 high side drivers for front and rear lighting outputs
- High current, low Rds(on),100V, 120V power MOSFETs
- Protection: over-temperature, over-voltage, over-current, Hall fault, motor stall, and more
- Operating temperature -40°C to +85°C, can be extended on request to -55°c

Motors

- Brushed motors
- Brushless motors with Hall– sinusoidal commutation
- Brushless motors with Hall and incremental encoder –smooth sinusoidal commutation

Current control

- Fully digital, closed loop PI at 2.5 kHz BW
- 20kHz PWM
- Sinusoidal commutation with vector control (PID) or trapezoidal commutation with encoder and/or digital Hall sensors
- 20 kHz sample rate, 12-bit current loop resolution
- DC bus power supply compensation
- Autotuning
- Back EMF measurement and Id Iq correction

Speed control

- Closed loop PID at 500 kHz BW
- Programmable PID
- Feed forward
- Control filters
- Gain scheduling
- Autotuning

Position control

- Closed loop PID at 200 Hz BW
- Programmable notch and low-pass filters
- External incremental encoder position feedback loop

Communication

Two communication options:

- CANBUS 1939J, 1Mb/Sec (optional CANopen)
- RS232 serial communication

Feedback

- Incremental encoder – up to 1 MHz counts per second (250 kHz channel input), differential or single-ended encoder inputs
- Digital Hall sensors – up to 12 kHz counts per second (2 kHz channel inputs)
- Sin-Cos sensor feedback

Specifications

Absolute Max

Parameter	Description	Units	Min	Typ.	Max
Motor voltage		V	15	24-72, 96	120
5V output	Supply voltage for encoder and Hall sensors	mA	0		350
Logic voltage		V	15	24	80
Digital input	5 channels	V	-0.5		27
Analog input	3 channels	V	-2		7
Operating temperature		°C	-40		65
Storage temperature		°C	-65		150

Electrical

Parameter	Description	Units	Min.	Typ.	Max.
Motor voltage	Recommended working range	V	15	48	72
Input capacitance		µF	-	660	-
External capacitance	Additional capacitance required per motor ampere	µF/A	22.0	30	
Quiescent current	Logic power consumption @24V	mA		45	
Motor current (EV RIDER 85)	RMS current	Arms		85	250
Motor current (EV RIDER 135)	RMS current	A rms		135	520
Motor current (EV RIDER 200)	RMS current	Arms		200	520
5V output	Current for encoder and Hall sensors	mA	-	145	350
Serial communication	Baud rate	Kbit/sec	9.6	230	960
	Packet rate	mSec.	0.5		
Sleep Mode	Without BLE	µA	100	150	200
CAN	Baud rate	kHz	50		1000
	Packet rate	mSec.	1		
Analog input	Input voltage range	V	0		5
Inputs	5 channels	V	0		24
Outputs	High side driver max. 72V	mA	0		150

Parameter	Description	Units	Min.	Typ.	Max.
Digital inputs V-IH	High-level input voltage	V	3		24
Digital inputs VIL	Low-level input voltage	V	0		1.2
~~ADC~~	Resolution	bit		12	
	Noise	V_{RMS}		0.5mV	
PWM frequency		kHz	10	20	60
Current loop	Closed loop BW	kHz		2.5	
Speed loop	Closed loop BW	Hz		500	
Position loop	Closed loop BW	Hz		200	
Current sensors	Sample frequency	kHz		20	
Motion feedback	Sample frequency	kHz		20	
I/Os	Sample frequency	kHz		0.1	
Power up	Power to communication	sec			0.75
DSP clock		MHz		90	
Crystal	@20 MHz, accuracy	ppm	-50		+50
	Power to motor command	sec			1
	Packet response	µsec		25	100
	Packet period from master	msec	0.5		

Motor feedback

Parameter	Description	Units	Min	Typ	Max
Incremental	Resolution	bit	2		30
	Max input frequency	kHz		250	
Hall	Resolution in electrical turn, 60 degrees and 120 degrees	steps		6	
	Max input frequency	kHz		20	
Hall LPF	RC filter and debounce	kHz		50	
Encoder input V_{IH}	High-differential level input voltage	V		0.2	
Encoder input V_{IL}	Low-differential level input voltage	V		-0.2	
Encoder termination	Between positive and negative terminals	Ω		120	
Hall input H	High-level input voltage	V	2		5
Hall input L	Low-level input voltage	V	0		0.8

Stabilization storage and IOT

Parameter	Description	Units	Min	Typ	Max
Acceleration	Accelerometer X,Y,Z	g	-	±32	-
Gyroscope	Rate Gyro yaw, pitch, roll	Degrees/Sec		±2000	
Processing	Machine Learning processing			Internal	
Gyro FIFO	Internal storage	Kbytes		9	
Nonvolatile storage	IIC EEprom		2	8	32

Mechanical

Parameter	Description	Units	Min	Typ	Max
Dimensions		mm			
Weight		gram		330	
Connector type					
Mating connectors					
Thermal pads	Pads between MOSFET and heatsink	mm		0.5	

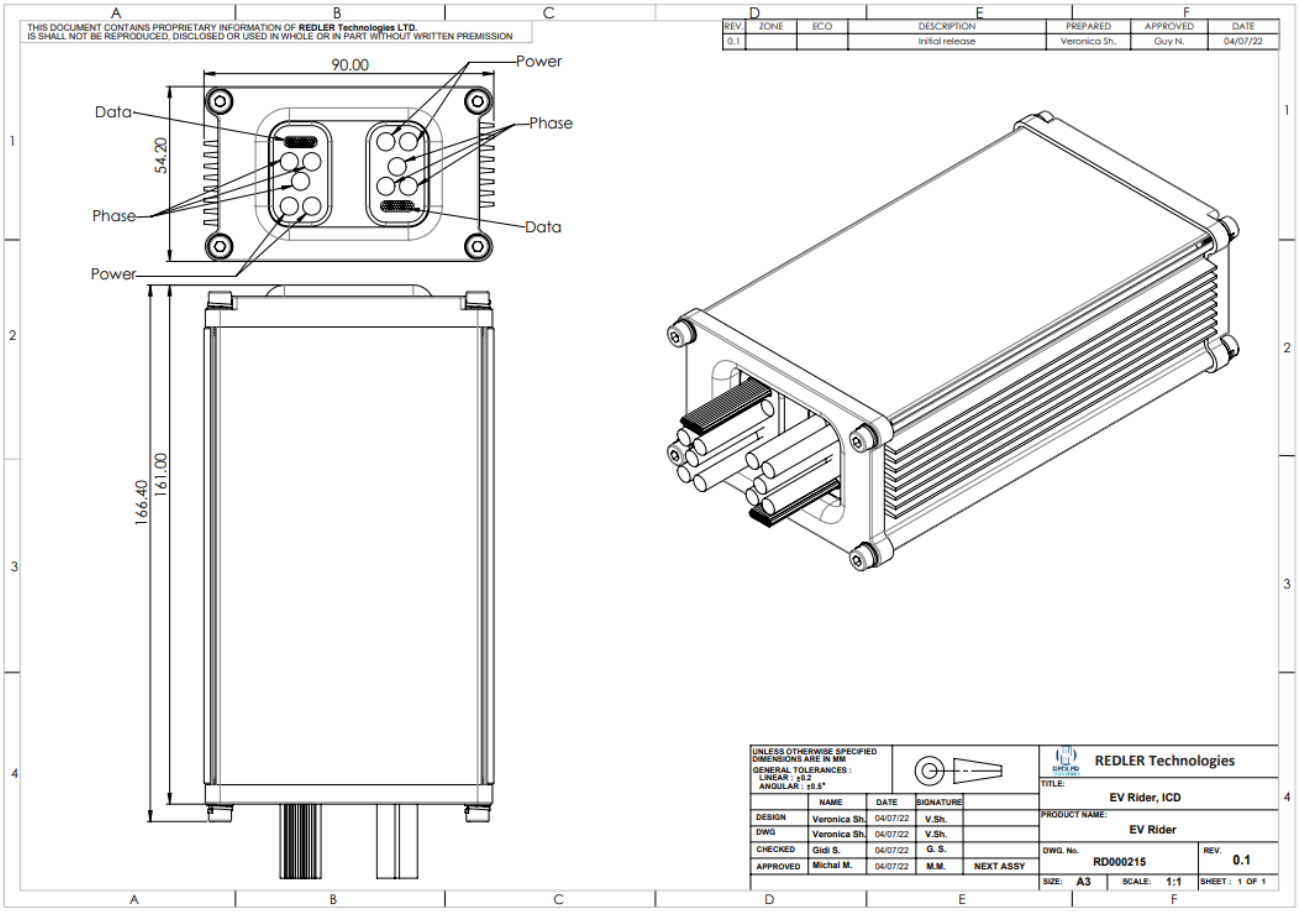
Environment

Parameter	Description	Units	Min	Typ	Max
Operating temperature	For derating table, contact Redler	°C	-40		85

Storage temperature		°C	-65		150
Vibration	Contact Redler				
EMC	Contact Redler				
ESS	Contact Redler				
Altitude	Contact Redler				

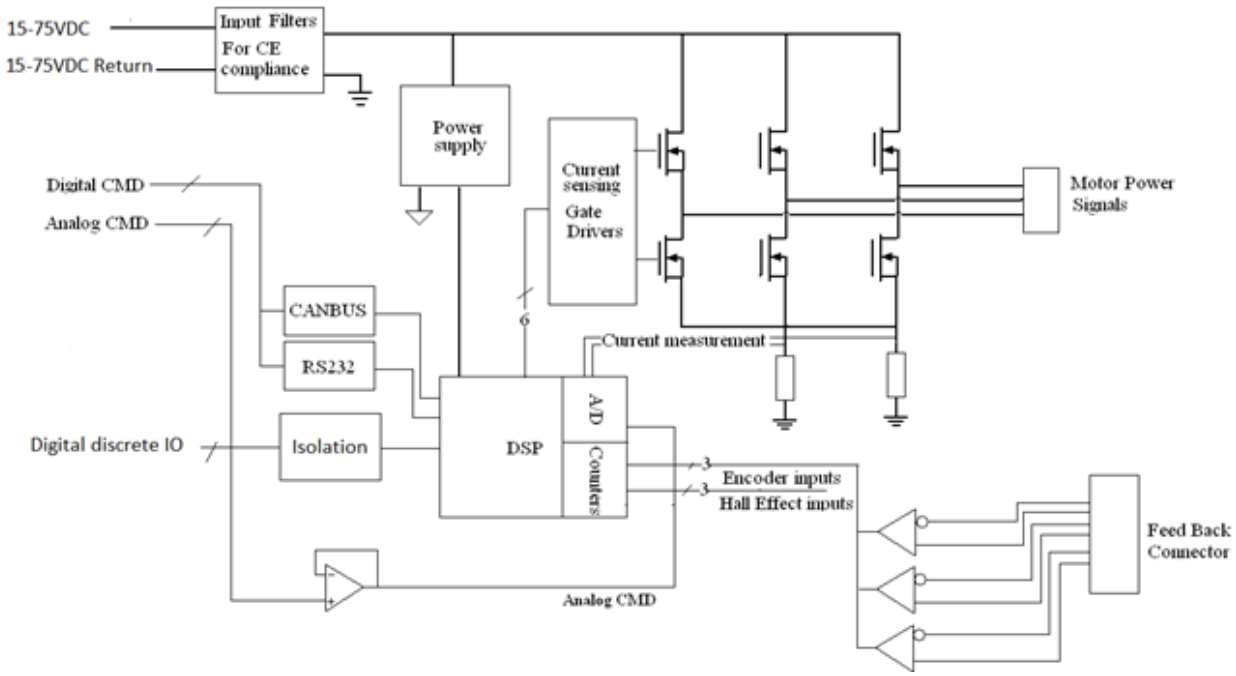
Dimensions

Dimensions - RD00214



Wiring

System architecture



System architecture

Power

Cables 10 Gauge

Pin #	Signal Name	Signal Description
1	V Motor +	Motor power supply 15 to 72V
2	V Motor Return	Motor power supply return
3	Phase A	Motor phase A
4	Phase B	Motor phase B
5	Phase C	Motor phase C

ReGen

Cables 16 Gauge

Pin #	Signal Name	Signal Description
PAD8	V Motor +	Connect to External Power resistor 100 Ω
PAD9	ReGen transistor	Connect to External Power resistor 100 Ω

IO Signals (Internal PCB Connectors)

I/O Signals (Internal PCB Connectors)

- J1- SamtecTMM-108-01-T-S Do not use- Radio connector
- J2- WE-490107670612 JTAG programing connector do not use- Debug connector
- J3- Molex 105310-1108 Display and communication connector
- J4- Molex 1053101114 Digital, Analog and front and rear light out connector
- J5- Molex-105310-1106 Motor Hall effect sensors connector
- J6- Molex 105310-1108 (Optional) Incremental encoder interface connector
- J7- Molex 105310-1108 connector (Optional) STO and Master/Slave communication

J3 legend

J3 Pin#	Signal Name	Signal Description
1	RS232_RX_CAN_H	RS232 Rx signal (Data to EV-Rider) or optional CAN H
2	RS232_TX_CAN_L	RS232 Tx signal (Data from EV-Rider) or optional CAN L
3	CTL_Power_In	Power input for the EV-Rider control section 12-72V DC ~50A
4	CTL_PWR_On	Power down signal to set EV-Rider to sleep mode (leave open)
5	Digital Ground	Digital and logic power supply voltage return 0V
6	Power Ground	Motor Bridges High Power voltage return 0V (leave open)
7	HALL_1_Reflected	TTL Output Tachometer signal.
8	VCC_Motor	Motor Bridges High Power voltage 12-72V (leave open)

Note: VCC_Motor and Power Ground are the power input for the vehicle display.

J4 legend

J4 Pin#	Signal Name	Signal Description
1	IN1	Input signal SPST switch input
2	IN2	Input signal SPST switch input
3	IN3	Input signal SPST switch input
4	Ext_Analog_Vin1	Analog input 0-5V
5	Ext_Analog_Vin2	Analog input 0-5V
6	VCC_Analog_OUT_5V	Excitation voltage output for Throttle and analog breaking signals
7	Beep	High side driver. Reflects Motor In voltage 0.5 Ampere max.

8	IN4	Input signal SPST switch input	
9	IN5	Input signal SPST switch input	
10	VCC_OUT_5V	Excitation voltage output for SPST switches 5V 100m Ampere max	
11	Digital Ground	Digital voltage return 0V	Digital and logic power
12	Rear_Light	High side driver. Reflects Motor In voltage 0.5 Ampere max.	
13	Front_Light	High side driver. Reflects Motor In voltage 0.5 Ampere max.	
14	Power Ground	Power voltage return 0V for High side drivers	

J5 legend

J5 Pin#	Signal Name	Signal Description
1	H1	Hall sensor 1 input 0-5V
2	H2	Hall sensor 2 input 0-5V
3	H3	Hall sensor 3 input 0-5V
4	Digital Ground	Hall sensors Ground 0V
5	VCC_OUT_5V	Hall sensors power supply 5V 100mA
6	Digital Ground	Hall sensors Ground 0V

J6 legend (Optional)

J6 Pin#	Signal Name	Signal Description
1	ENC1_CLK_A	Incremental encoder CLK A RS422 receive signal + 120Ω termination
2	ENC1_CLK_B	Incremental encoder CLK B RS422 receive signal + 120Ω termination
3	ENC1_IDX	Incremental encoder INDEX RS422 receive signal + 120Ω termination
4	VCC_OUT_5V	Incremental encoder power supply 5V 250mA
5	ENC1_CLK_An	Incremental encoder CLK A not RS422 receive signal + 120Ω termination
6	ENC1_CLK_Bn	Incremental encoder CLK B A not RS422 receive signal + 120Ω termination
7	ENC1_IDXn	Incremental encoder INDEX A not RS422 receive signal + 120Ω termination
8	Digital Ground	Incremental encoder Ground 0V

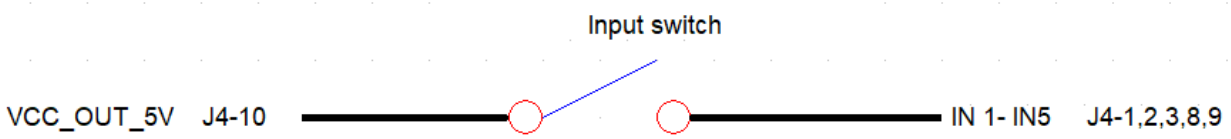
J7 legend (Optional)

J7 Pin#	Signal Name	Signal Description
1	Digital Ground	Incremental encoder Ground 0V
2	NC	Do not Connect
3	STO-0	STO0 input 0-24V Normally close signal
4	STO-1	STO1 input 0-24V Normally close signal
5	Mastern_Slaven	Master Slave addressing. Leave open for master in a single controller arrangeme

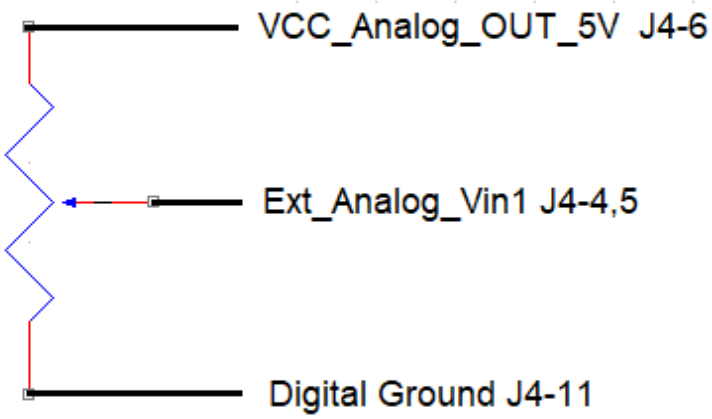
6	ADD_0_in	Controller addressing signal Leave open in a single controller arrangement
7	Master_Slave_RX_TX	Controllers’ communication half duplex signals Leave open in a single controller
8	ISOLATED Ground	Isolated ground for STO signals.

Wiring

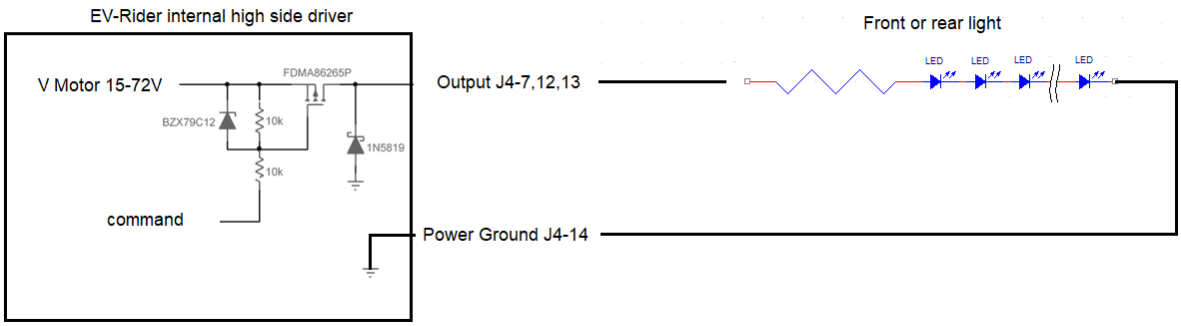
Input switchs



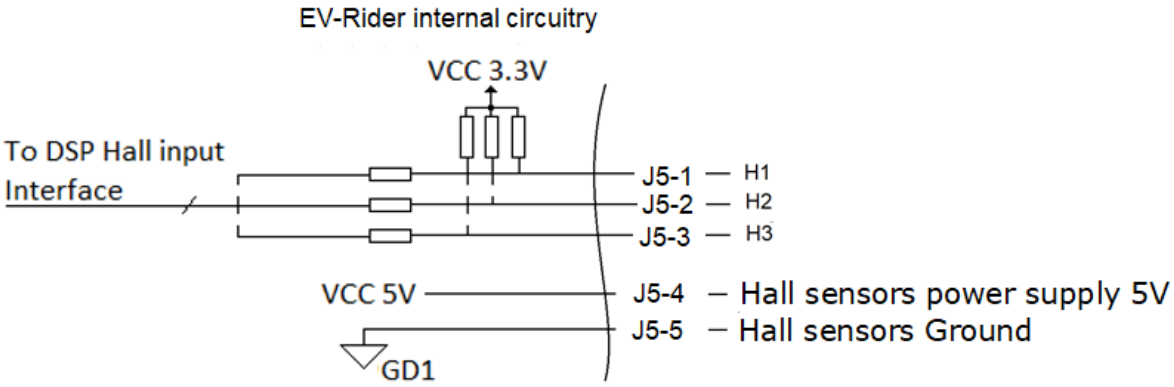
Input Analog signals (throttle)



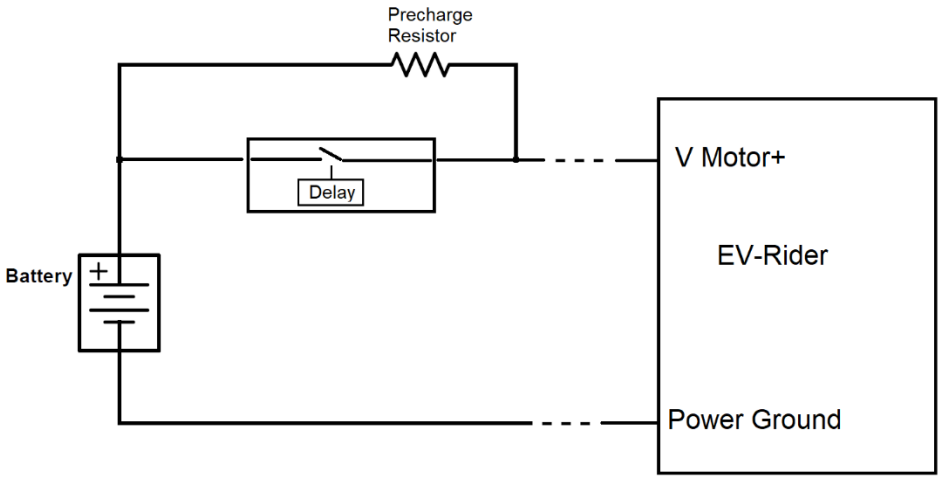
Front and rear light



Hall effect sensors interfce



Power signals connection



Regenerative power absorption