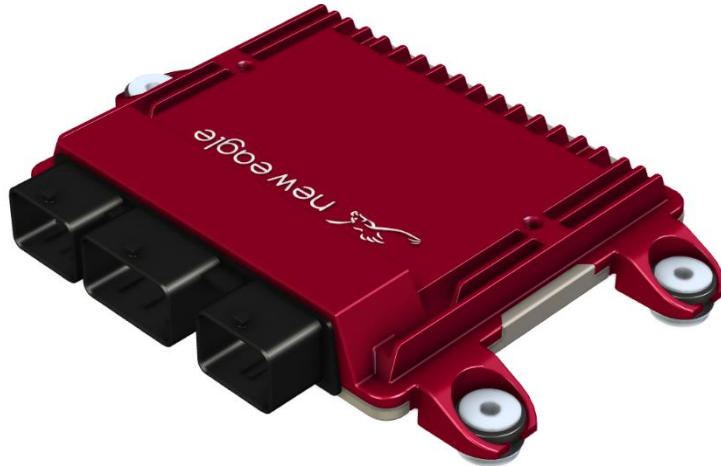# RCM112-2202

Raptor Control Module
P/N: RCM-58NN-112-2202

The RCM112-2202 is Raptor Control Module designed to operate at 12V or 24V for Electric Vehicle Supervisory control, Autonomous Drive-By-Wire, and Other Mechatronic Applications.

The RCM112-2202 has extensive communications capability with its 5 CAN FD channels including Wake on CAN5, 2 LIN buses with LIN2 able to be configured for either Master or Slave and also supports Wake-on-LIN, 2-wire Ethernet with Wake support, and SENT communications support.

A variety of configurable inputs and outputs are available including an internal 6-axis Inertial Measurement Unit (Accelerometer) as well as a Real-Time Clock.

This powerful module is perfect for applications that require advanced performance, timing systems, and functional safety capabilities. The CPU is a high-performance, multi-core architecture with a companion safety power system basis chip that can support the highest level of functional safety (ASIL-D). The RCM112-2202 is a rugged production controller that uses an open, model-based software development process using MATLAB/Simulink and Raptor to speed up development and testing.

For more details, contact sales@neweagle.net

- **Programming**
  - MATLAB Simulink with Raptor
- **Processor**
  - ST SPC58NN84C3
  - 200 MHz
- **ASIL-D Capable**
- **Memory**
  - 6 MB App Flash
  - 32 KB EEPROM
  - Additional 8MB Flash Memory
  - 608 KB Internal RAM
- **45 Inputs**
  - 30 Analog Inputs
  - 12 Digital/Frequency Inputs
    - 3 Hall Effect / 2 VR
    - 2 12V/24V Inputs
  - 1 Wake Input (Key-Switch)
- **40 Outputs**
  - 16 Low Side Drivers (PWM)
  - 16 High Side Drivers (PWM)
  - 4 Full Half-Bridge Drivers (PWM)
  - 4 Sensor Power Outputs
- **Internal Accelerometer (IMU)**
- **Real Time Clock (RTC)**
- **8V-32V Operating Voltage**
- **Communication**
  - 5 CAN FD
    - Wake on CAN5
  - 2 LIN
    - LIN2 Master/Slave (SW Config) with Wake-on-LIN2
  - 1 Ethernet (2-Wire Automotive Broad-R-Reach) with Wake
  - 4 SENT
- **Environmental**
  - -40°C to 105°C Operating Temp
  - IP69k Intent
- **Compiler**
  - S32DS for Power Architecture Version V2.1 (Free from NXP)
- **Aluminum Construction**
- **Weight**
  - 1.6lb (.72kg)

Table of Contents

1. Controller Overview

Hardware	
Microprocessor	ST SPC58NN84C3
Clock Speed	200 MHz
Environmental	IP6k7
Operating Temp	-40°C to 105°C

Memory Segments	
Memory Segment	Size
FLASH	6 MB
EEPROM	32 KB
External Flash Memory	8MB
INTERNAL RAM	608 KB

Communication Channels		
Channel	Functions	Options
CAN1	CAN	125k 250k 500k 666.7k 1000k
CAN2	CAN	125k 250k 500k 666.7k 1000k
CAN3	CAN	125k 250k 500k 666.7k 1000k
CAN4	CAN	125k 250k 500k 666.7k 1000k
CAN5	CAN WAKE-ON-CAN	125k 250k 500k 666.7k 1000k

Communication Channels		
Channel	Functions	Options
LIN1	LIN MASTER	1200 2400 4800 11200 10400 19200
LIN2	LIN MASTER LIN SLAVE Wake-on-LIN	1200 2400 4800 11200 10400 19200
ETH1	ETHERNET	BroadR-Reach 2-wire

Note: CAN1 Default Baud is 500k

Inputs		
Resource	Functions	Measurable Range
WAKE_INPUT1	analog_in	0V - BATT
DG1	freq_in digital_in	$0 - 5V$
DG2	freq_in digital_in	$0 - 5V$
DG3	freq_in digital_in	$0 - 5V$
DG4	freq_in digital_in	$0 - 5V$
DG5	freq_in digital_in	$0 - 5V$
DG6	freq_in digital_in	$0 - 5V$
DG7	freq_in digital_in	$0 - 5V$
DG8	freq_in digital_in	$0 - 5V$
DG9	freq_in digital_in	$0 - 5V$
DG10	freq_in digital_in	$0 - 5V$
DG11	freq_in digital_in	$0V - BATT$
DG12	freq_in digital_in	$0V - BATT$

Inputs		
Resource	Functions	Measurable Range
AN1	analog_in	0 - 5 V
AN2	analog_in	0 - 5 V
AN3	analog_in	0 - 5 V
AN4	analog_in	0 - 5 V
AN5	analog_in	0 - 5 V
AN6	analog_in	0 - 5 V
AN7	analog_in	0 - 5 V
AN8	analog_in	0 - 5 V
AN9	analog_in	0 - 5 V
AN10	analog_in	0 - 5 V
AN11	analog_in	0 - 5 V
AN12	analog_in	0 - 5 V
AN13	analog_in	0 - 5 V
AN14	analog_in	0 - 5 V
AN15	analog_in	0 - 5 V
AN16	analog_in	0 - 5 V
AN17	analog_in	0 - 5 V
AN18	analog_in	0 - 5 V
AN19	analog_in	0 - 5 V
AN20	analog_in	0 - 5 V
AN21	analog_in	0 - 5 V
AN22	analog_in	0 - 5 V
AN23	analog_in	0 - 5 V
AN24	analog_in	0 - 5 V
AN25	analog_in	0 - 5 V
AN26	analog_in	0 - 5 V
AN27	analog_in	0 - 5 V
AN28	analog_in	0 - 5 V
AN29	analog_in	0 - 5 V
AN30	analog_in	0 - 5 V

Outputs		
Resource	Functions	Driver Types
MPRD	digital_out	Digital Output
HB_A	hbridge_out output_status internal_measurement	Half-Bridge Current Feedback
HB_B	hbridge_out output_status internal_measurement	Half-Bridge Current Feedback
HB_C	hbridge_out output_status internal_measurement	Half-Bridge Current Feedback
HB_D	hbridge_out output_status internal_measurement	Half-Bridge Current Feedback
HSO1	digital_out pwm_out output_status internal_measurement	High Side Current Feedback
HSO2	digital_out pwm_out output_status internal_measurement	High Side Current Feedback
HSO3	digital_out pwm_out output_status internal_measurement	High Side Current Feedback
HSO4	digital_out pwm_out output_status internal_measurement	High Side Current Feedback
HSO5	digital_out pwm_out output_status	High Side
HSO6	digital_out pwm_out output_status	High Side
HSO7	digital_out pwm_out output_status	High Side
HSO8	digital_out pwm_out output_status	High Side

Outputs		
Resource	**Functions**	**Driver Types**
HSO9	digital_out pwm_out output_status	High Side
HSO10	digital_out pwm_out output_status	High Side
HSO11	digital_out pwm_out output_status	High Side
HSO12	digital_out pwm_out output_status	High Side
HSO13	digital_out pwm_out output_status	High Side
HSO14	digital_out pwm_out output_status	High Side
HSO15	digital_out pwm_out output_status	High Side
HSO16	digital_out pwm_out output_status	High Side
LSO1	digital_out pwm_out output_status internal_measurement	Low Side Current Feedback
LSO2	digital_out pwm_out output_status internal_measurement	Low Side Current Feedback
LSO3	digital_out pwm_out output_status internal_measurement	Low Side Current Feedback
LSO4	digital_out pwm_out output_status internal_measurement	Low Side Current Feedback
LSO5	digital_out pwm_out output_status internal_measurement	Low Side Current Feedback

Outputs		
Resource	Functions	Driver Types
LSO6	digital_out pwm_out output_status internal_measurement	Low Side Current Feedback
LSO7	digital_out pwm_out output_status internal_measurement	Low Side Current Feedback
LSO8	digital_out pwm_out output_status internal_measurement	Low Side Current Feedback
LSO9	digital_out pwm_out output_status	Low Side
LSO10	digital_out pwm_out output_status	Low Side
LSO11	digital_out pwm_out output_status	Low Side
LSO12	digital_out pwm_out output_status	Low Side
LSO13	digital_out pwm_out output_status	Low Side
LSO14	digital_out pwm_out output_status	Low Side
LSO15	digital_out pwm_out output_status	Low Side
LSO16	digital_out pwm_out output_status	Low Side

| Internal Measurements		
Resource	Units	Note
Sensor_Power_A	V	5V Sensor Power A
Sensor_Power_B	V	5V Sensor Power B
Sensor_Power_C	V	5V Sensor Power C
Sensor_Power_D	V	5V Sensor Power D
BATT_VOLTAGE	V	Battery Voltage
WAKE_INPUT1_VOLTAGE	V	Wake_Input Voltage
DRVP_VOLTAGE	V	Driver Power Voltage
HB1+_HIGH CURRENT	mA	Half Bridge 1A High Side Current
HB1+_LOW CURRENT	mA	Half Bridge 1A Low Side Current
HB1-_HIGH CURRENT	mA	Half Bridge 1B High Side Current
HB1-_LOW CURRENT	mA	Half Bridge 1B Low Side Current
HB2+_HIGH CURRENT	mA	Half Bridge 2C High Side Current
HB2+_LOW CURRENT	mA	Half Bridge 2C Low Side Current
HB2-_HIGH CURRENT	mA	Half Bridge 2D High Side Current
HB2-_LOW CURRENT	mA	Half Bridge 2D Low Side Current
HSO1_CURRENT	mA	HSO1 Current Sense
HSO2_CURRENT	mA	HSO2 Current Sense
HSO3_CURRENT	mA	HSO3 Current Sense
HSO4_CURRENT	mA	HSO4 Current Sense
LSO1_CURRENT	mA	LSO1 Current Sense
LSO2_CURRENT	mA	LSO2 Current Sense
LSO3_CURRENT	mA	LSO3 Current Sense
LSO4_CURRENT	mA	LSO4 Current Sense
LSO5_CURRENT	mA	LSO5 Current Sense
LSO6_CURRENT	mA	LSO6 Current Sense
LSO7_CURRENT	mA	LSO7 Current Sense
LSO8_CURRENT	mA	LSO8 Current Sense
IMU	dps (gyroscope) g (accelerometer)	Internal 6-Axis Motion Tracker IAM-20680
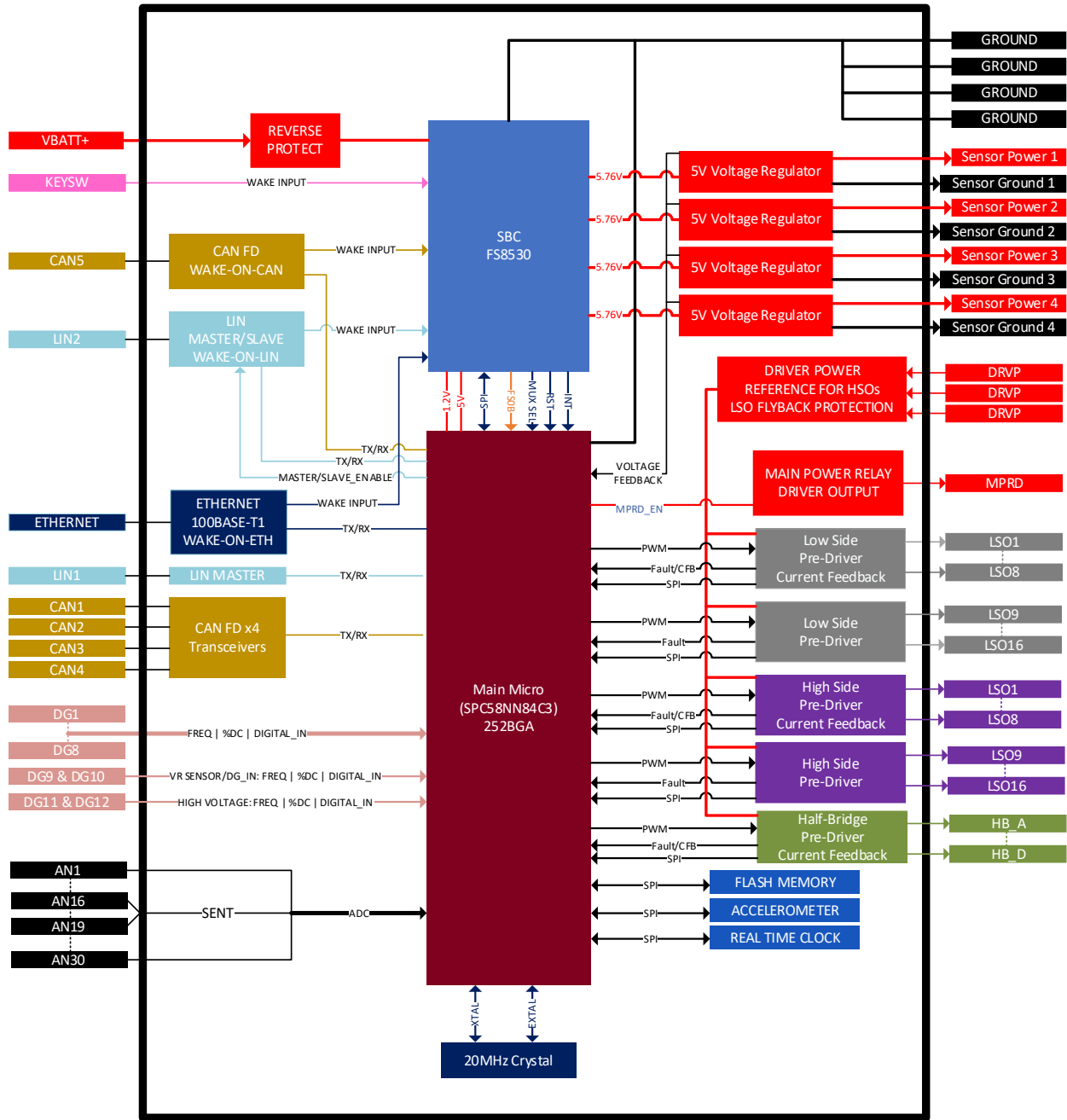
Figure 1: RCM-58NN-112-2202 Block Diagram

3. Communication

There is no internal termination of the CAN Buses.
The RCM112-2202 has a total of 5 CAN FD buses. The module is capable of Wake on **CAN5**.
The RCM112-2202 has 2 LIN buses, one of which is capable of Master or Slave configuration in software. The module is capable of Wake on **LIN2**.
The RCM112-2202-2202 has a two-wire Ethernet.

4. Power

The logical battery input should be permanently connected to battery voltage. This battery input is needed to power the microprocessors when awake. It should be fused independently of the entire system to ensure that there is not excess current on the logic power traces.

Note: The RCM is protected against reverse polarity supply voltage of up to 32V for up to 5 minutes.

Note: Jump Start with battery voltage of 48V is permitted up to 5 minutes at ambient temperature 23°C +/-5°C. However, the RCM112-2202 will turn off if exposed to voltages approximately over 38V but will not be damaged. The battery of the vehicle must be connected.

Note: The BATT+ and Wake_Input1 inputs have reverse battery protection.

4.1 Max Ratings

	Min	Nom	Max	Units
Input Voltage: Normal Operation	8	13.8/27.6	32	V
Jump Start (Up to 5 min) *			48	V
Reverse Battery Protection (Up to 5 min)			-32	V
Current Draw: Off-State Current			0.5	mA

*Note: The RCM will turn off if exposed to voltage over 38V but will not be damaged.

4.2 Power Inputs (BATT, GND)

Connect the power source positive to the BATT input (8V-32V) and the power source common to GND.

4.3 Internal Battery Measurement (Analog)

Within the software, the BATT input is available as an internal measurement through the "internal measurement" block.

Software Resource	ADC Range	Theoretical Range
BATT	0-4096	0-42V

4.4 Wake Input (Pin Name: WAKE_INPUT1)

4.4.1.1 Wake from Key Switch (KEYSW)

The controller monitors the voltage on the key switch (Wake_Input1) pin to determine when it should power up. When the voltage level on the key switch pin exceeds 8V, the controller "wakes up" and begin executing the application software. At this point, the WAKE_INPUT1 input acts simply as an analog input. When WAKE_INPUT1 voltage goes low, the typical application will commence a shutdown sequence (e.g., to complete application routines and/or store non-volatile memory); however, this decision is application-specific, and the programmer can customize the shutdown logic in the software.

When the controller is shutdown from the application, the controller returns to the low-power ("sleep") state. WAKE_INPUT1 is the only wake source. Table 1 shows the power states of the RCM.

BATT (8-32V always ON)	Wake_Input1	MPRD	Micro	Comments
ON, <500uA	OFF	OFF	OFF	Micro off, <500uA current on V_BATT
ON	ON	OFF	ON	When WAKE_INPUT1 goes high (>8V), power supplies turn ON, then micro turns ON. WAKE_INPUT1 is a sense line and should be <10mA.
ON	ON	ON	ON	Micro actuates MPRD, RCM operates normal
ON	ON	OFF	ON	E.g. Case: Micro detects an overcurrent and turns OFF MPRD, but continue to operate and send diagnostics
ON	ON	ON	ON	E.g. Case: Micro detects overcurrent case resolved and turns ON MPRD
ON	OFF	ON	ON	Micro senses WAKE_INPUT1 status and begins shutdown process
ON	OFF	OFF	ON	E.g. Case: Micro turns OFF MPRD
ON, <500uA	OFF	OFF	OFF	Micro shuts down and everything is OFF.

Table 1: Power States

Note: WAKE_INPUT1 is protected from negative voltage transients and reverse battery connection.

4.4.1.2   Wake from CAN

The controller can wake on CAN 5.

4.5   Main Power Relay Driver (MPRD) Output

The Main Power Relay Driver (MPRD) Output is used to control the power to external loads that are connected to the module. For example, power to the injectors, ignition coils, wastegate control valve, etc., can be switched on and off through relays that are connected to the DRVP power source which is controlled via MPRD. Normally-open relays should be used to connect power to the injectors, as pictured below. It is assumed that the architecture for any system that employs the RCM112-2202 will use the MPRD output to switch power through the main power relay. An internal blocking diode is used to protect the MPRD output against reverse battery connection. The maximum sinking current for the MPRD output is 1A.

Note: Failure to use the Main Power Relay power distribution architecture will cause output drivers and actuators to be unprotected from a reverse battery condition and will void warranty for this failure mode.

Note: The driver is thermally self-protected and will provide shutdown fault detection. Open-load detection must be based on DRVP diagnostics.
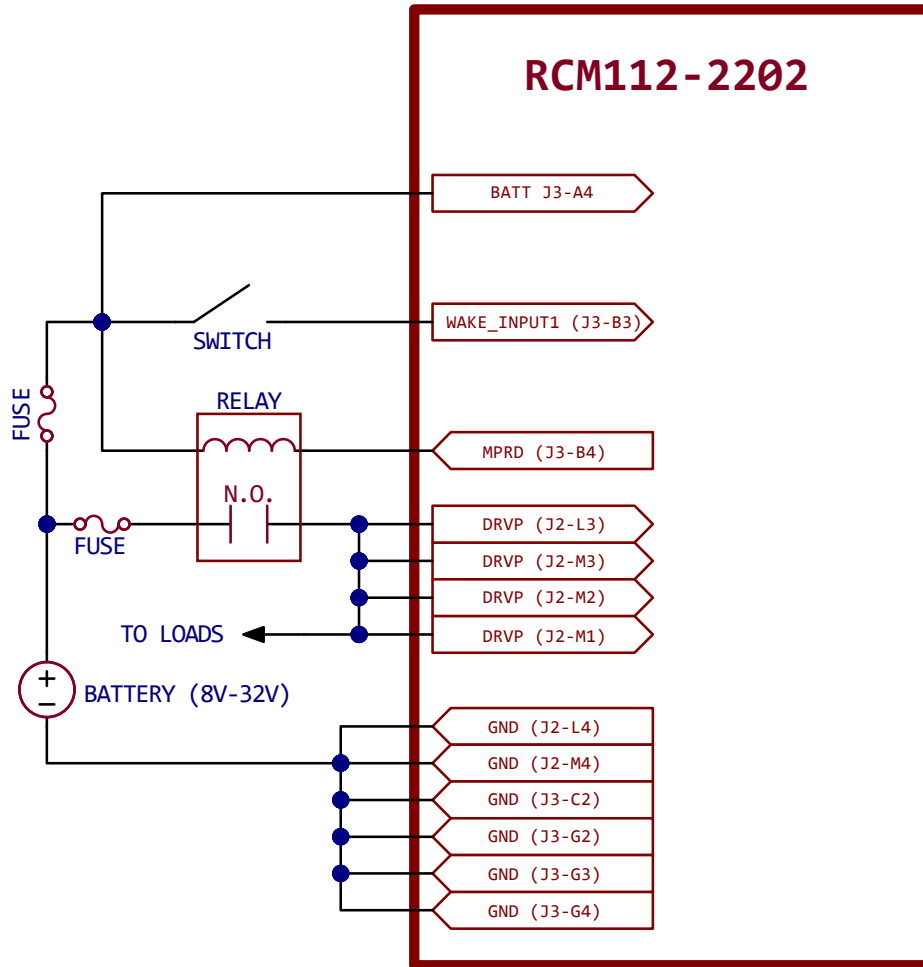
Figure 2: Input Power Wiring Diagram

4.1   Driver Power (DRVP)

The Driver Power (DRVP) pins provide the power source for outputs that source power internal to the module (such as the H-Bridge and high side drivers), as well as act as a node for connection to Low-Side Output Loads. Low Side output loads should be referenced between the LSO output and the node between the MPR and DRVP pins (labeled as "To Loads" in Figure 2 above). All DRVP pins are connected internally.

A Main Power relay architecture provides protection for:

Reverse Battery Protection. In the case of a reverse battery connection, an improper setup (without a main power relay) risks unintended low-side output actuation due to a reverse battery conduction path through the MOSFETs. This module utilizes an external main power relay architecture, which eliminates this risk. DRVP has a reverse battery diode and thus will not actuate in a reverse battery connection; therefore, all actuators sourcing power from driver power will be isolated and unactuated.

Short Protection. A typical vehicle has its entire chassis grounded, and thus a wire shorting to ground is a relatively common fault scenario. In the case of a short-to-ground on the control side of an output, an improper setup cannot prevent full-on output actuation. However, this architecture allows the output to be isolated by opening the circuit once the malfunction has been detected. Note that this action will

disable all low-side drivers, but this is a compromise to the more-expensive high-side drivers. This architecture also protects against shorts to battery.

4.2 Driver Ground (DRVG)

The driver ground (DRVG) pins are the single point ground for the controller. This connection provides the primary current return path to the system ground (battery negative). The RCM wiring harness should ensure that all ground connections from the RCM terminate at a single point (e.g., negative battery terminal). All DRVG pins are connected internally.

4.3 Sensor Power Outputs

The RCM112-2202 control provides four external Sensor Power sources of up to +5 Vdc. This power output is protected against over-voltage, over-temperature, short circuits, and reverse power.
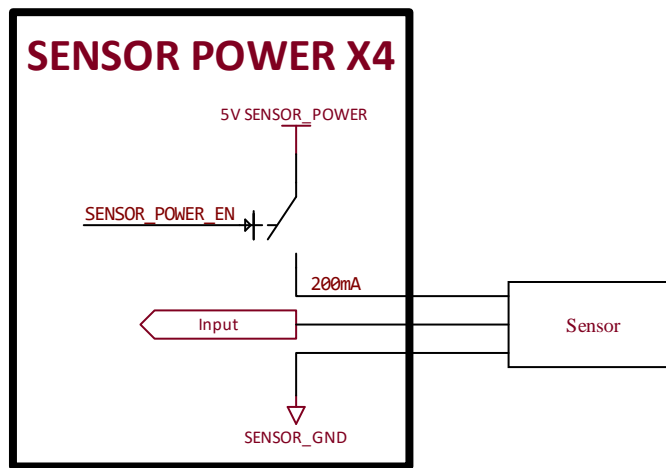

Figure 3: Sensor Output Power Wiring Diagram

4.3.1 Sensor Output Specifications and Measurement

Output	Voltage	Current Limit
SENSOR POWER	5 V ± 2.5 %	200 mA (each)
Resource	ADC	Theoretical Range
SENSOR POWER	0-4096	0-6V

5. Inputs

5.1 Analog Inputs (AN1-30)

All analog inputs have the following properties:

Analog Input Specifications				
Item	Min	Nom	Max	Unit
Input Voltage Range	0		5	V
Resolution		12		Bits
Over Voltage			VBATT	V
ADC Range	0		4096	
Cutoff Frequency		4825		Hz

5.1.1 Analog Inputs PD w/ Test (AN1, AN2, AN5, AN6)

These analog inputs are configured with a 249Ω pull-down(PD1) resistor (Figure 4). These inputs are designed to measure current loops of 4-20mA.
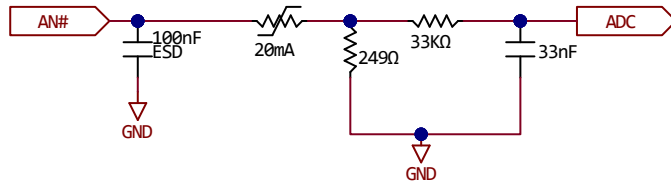
Function	PD1 Ω
AN1	249 PD
AN2	249 PD

Figure 4: Analog Input (with PD and Test Function) Circuit Diagram

5.1.2 Analog Inputs PD (AN3, AN4, AN7-AN14, AN20-AN23, AN25-AN26)

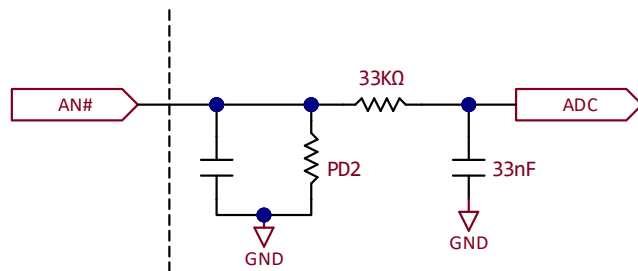These analog inputs are configured with pull-down (PD2) resistors (Figure 5).

Function	PD2 Ω
AN3	3.3k PD
AN4	3.3k PD
AN5	3.3k PD
AN6	3.3k PD
AN7	3.3k PD
AN8	3.3k PD
AN9	4.75k PD
AN10	4.75k PD
AN11	4.75k PD
AN12	4.75k PD
AN13	4.75k PD
AN14	4.75k PD
AN20	4.75k PD
AN21	4.75k PD
AN22	4.75k PD
AN23	4.75k PD
AN25	4.75k PD
AN26	4.75k PD

Figure 5: Analog Input (with PD Resistor) Circuit Diagram

5.1.3 Analog Input PU (AN16-19) (SENT RX)

These analog inputs are configured with a 33k PU resistor. These inputs can also be configured in software for SENT RX.
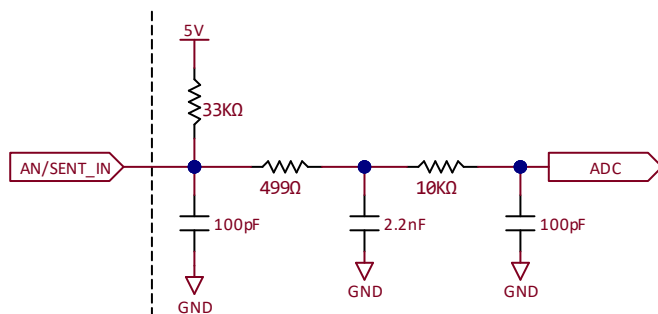
Function	PU2 Ω
AN16	33k PU
AN17	33k PU
AN18	33k PU
AN19	33k PU

Figure 6: SENT Circuit Diagram

The Single Edge Nibble Transmission (SENT) Receiver (SRX) module is a multichannel receiver for receiving serial data frames which are being transmitted by a sensor implementing the SENT encoding scheme and present them to the CPU for further processing.

SENT Rx Specifications				
Item	Min	Nom	Max	Unit
Compensation Variation	-25		25	%
Input Resolution			32	bits

5.1.4 Analog Input PU (AN15, AN24, AN27-AN30)

These analog inputs are configured with a pull-up (PU3) resistor.

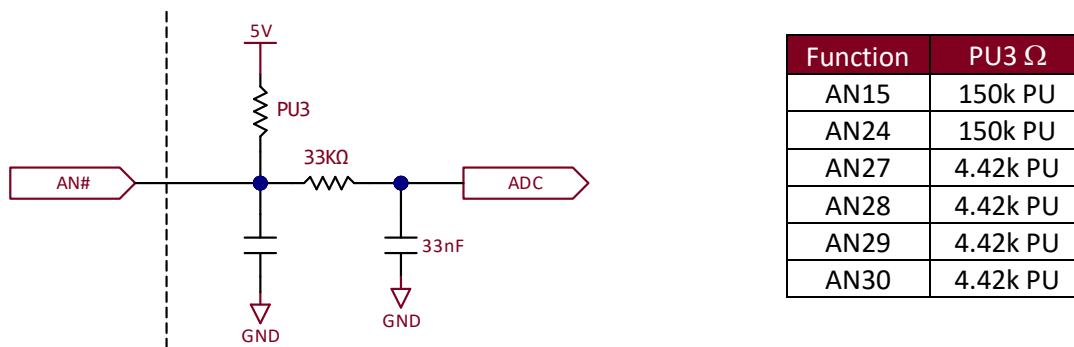| Function	PU3 Ω
AN15	150k PU
AN24	150k PU
AN27	4.42k PU
AN28	4.42k PU
AN29	4.42k PU
AN30	4.42k PU

Figure 7: Analog Input (with PU Resistor) Circuit Diagram

5.2 Digital/Frequency Inputs (DG1-DG10)

These inputs are configured to utilize a 1kΩ pull-up resistor which is configured in software. These inputs can operate as either a Digital Input (Logic High/Low) or as Frequency Inputs (Frequency/ Duty Cycle). These inputs can also be switched to BATT.
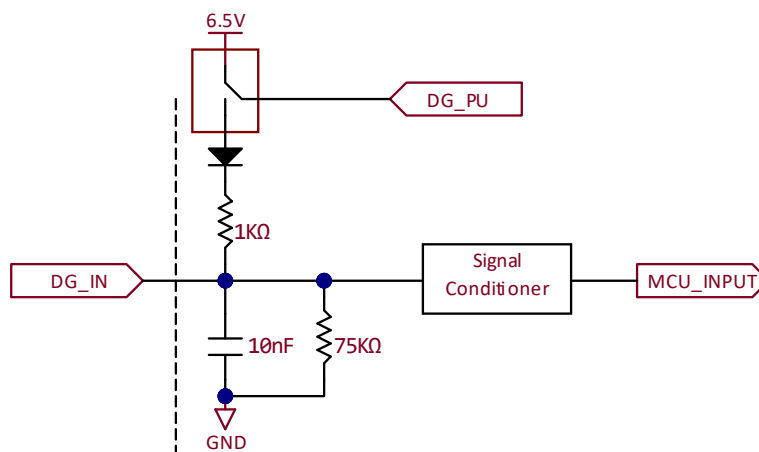

Figure 8: DG Input Circuit (with 1k selectable pull-up resistor)

	Min	Nom	Max	Units
Max Voltage	0		5	V
Max Frequency	4		20000	Hz

Logic High Threshold	3			V
Logic Low Threshold			1.9	V

5.2.1 DG1-DG3 (HALLA, HALLB, HALLC)

DG1-DG3 can be utilized as either Digital or Frequency inputs as defined above, or they can be utilized as Hall Effect Speed Feedback Inputs from a 3 Phase Brushless DC Motor.
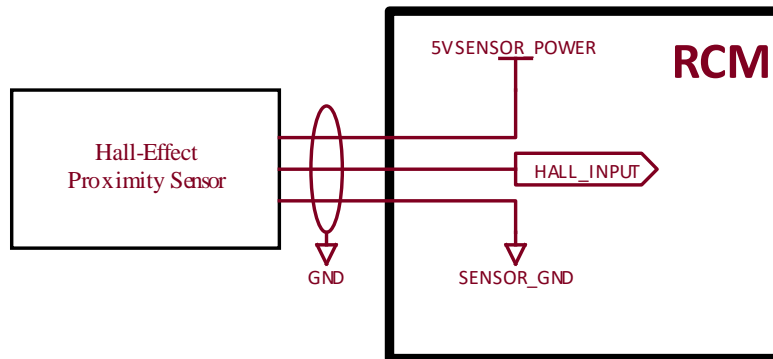
5.2.1.1   Digital

Figure 9: Digital Sensor Wiring Diagram

If Digital Mode is selected, the application software allows the programmer to select to either enable or disable a 1 kΩ pull-up resistor which can be used for open collector type sensors. The input circuit specifications are shown below:

5.2.1.1.1   Digital Frequency Input Specifications

Parameter	Specification
Input Voltage Thresholds at 25 deg C	ViL = 2.1V ViH = 2.85V
Pull-Up Selection	1 kΩ ± 1 % pull-up to internal 5V (software selectable)
DSS1 and DSS2 operating Frequency	250Hz to 10kHz
Cam and Crank operating Frequency	40Hz to 67kHz

5.2.2 DG9-DG10 (VR1+, VR2+)

DG9-DG10 can be utilized as either Digital or Frequency inputs as defined above or as single-ended VR Sensor Inputs. VR_RETURN (-) can be connected to any GND pin.
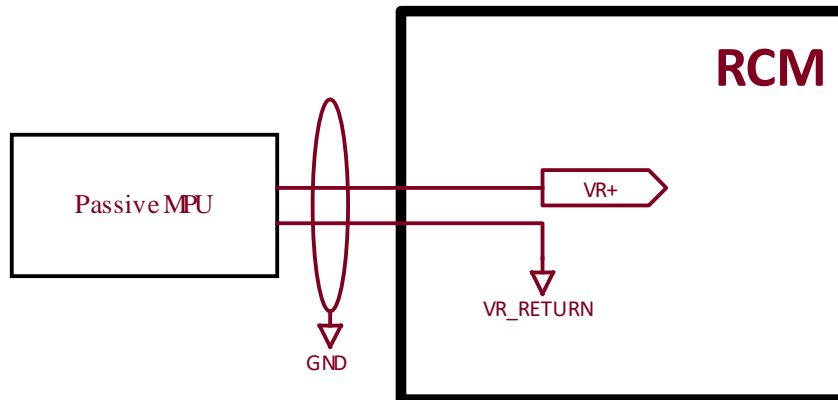
Figure 10: VR Sensor Wiring Diagram

Note: The application software allows the programmer to select either VR mode or Hall-effect mode for speed sensing. If VR mode is selected, the RCM112-2202 control utilizes an adaptive variable reluctance sensor amplifier that operates with a positive-going threshold, which is derived by peak-detecting the input signal.

5.2.2.1.1   VR Frequency Input Specifications

Parameter	Specification
VR polarity	Ensure VR sensor is connected such that there is a sharp falling edge signal.
Minimum signal amplitude	0.8 V peak (1.6Vpp)
Amplitude maximum (overspeed condition with minimum sensor gap)	100 V peak (200 Vpp)
Maximum Sensor Input Frequency	10kHz

5.3   12V/24V Digital/Frequency Inputs (DG11-DG12)

These inputs are configured to operate as 12V or 24V inputs and utilize a 75k pull-down resistor or 1k pull-up resistor which is configured in software. These inputs can operate as either a Digital Input (Logic High/Low) or as Frequency Inputs (Frequency/ Duty Cycle).
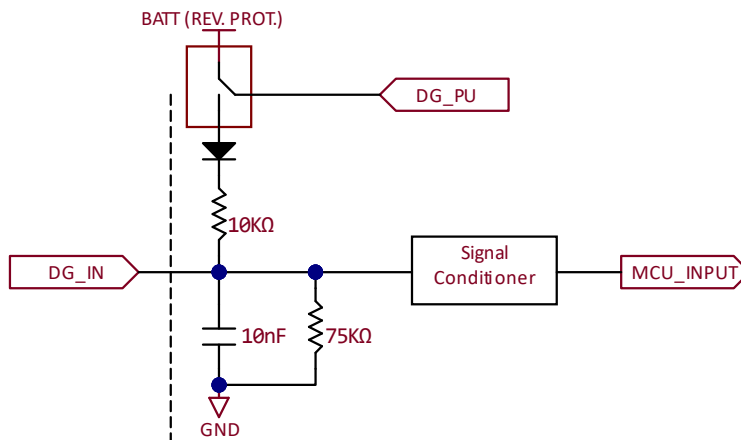

Figure 11: 12V/24V DG Input Circuit (with 10k Selectable pull- up resistor)

	Min	Nom	Max	Units
Max Voltage	0		12 | 24	V
Max Frequency	4		20000	Hz
Logic High Threshold	TBD			V
Logic Low Threshold			TBD	V

6. Outputs

6.1 High-Side Outputs (HSO1-HSO16)

The RCM112-2202 control has a total of 16 high-side outputs (HSO's) that can be used as Boolean Outputs for driving relays, or as PWM outputs to drive solenoids. All HSOs are protected against short circuits.

Note: HSO1-HSO4 support internal current sense which is available via the "internal_measurement" Raptor Block.

Figure 12: HSO Wiring Diagram

6.1.1 HSO Characteristics and Capabilities

Function	Drive Capability	Max Current	Notes
HSO1-4	Boolean or PWM	3A Cont. / 6A Max	Flyback Diode, Current Sense
HSO5-16	Boolean or PWM	3A Cont. / 6A Max	Flyback Diode

Max Ratings	Min	Nom	Max	Units
Frequency	4		20000	Hz

6.2 Low-Side Outputs (LSO1-LSO16)

The RCM112-2202 control has a total of 16 low-side outputs (LSO's) that can be used as Boolean Outputs for driving relays, or as PWM outputs to drive solenoids. All LSOs are protected against short circuits.

Note: LSO1-8 support internal current measurements, available via the "internal_measurement" Raptor Block.
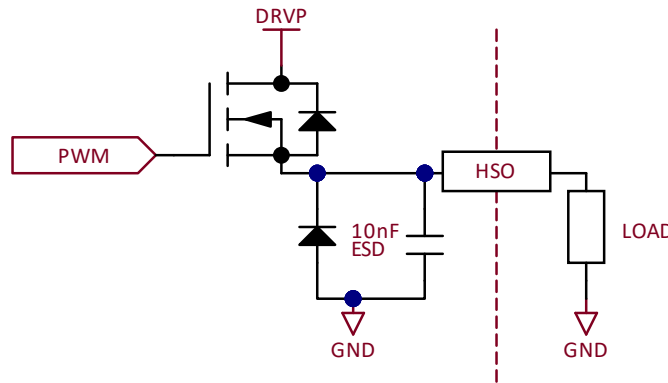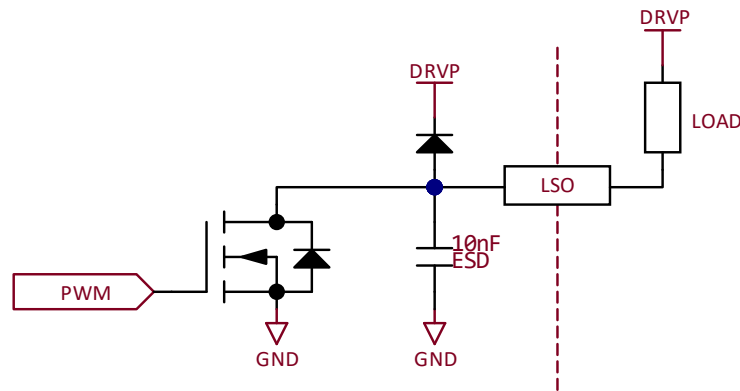
Figure 13: LSO Wiring Diagram

6.2.1 LSO Characteristics and Capabilities

Function	Drive Capability	Max Current	Notes
LSO1-8	Boolean or PWM	3A Cont. / 6A Max	Flyback Diode, Current Sense
LSO9-16	Boolean or PWM	3A Cont. / 6A Max	Flyback Diode

Max Ratings	Min	Nom	Max	Units
Frequency	4		20000	Hz
Voltage			VBATT	V

6.3 Half-Bridge (HB1, HB2, HB3, HB4)

The RCM112-2202 contains four Half-Bridges. The RCM112-2202 also has internal measurements for the High Side and Low Sides of each Half-Bridge output and can be monitored in Raptor. The Half-Bridge outputs have the following properties:

	Min	Nom	Max	Units
Output Current		5	8	A
High-Side Current Limitation	8	12	15	A
Frequency	4		20000	Hz

Half-Bridge Internal Current Measurement HB [1-4] [HIGH/LOW] _CS	Notes
Gain	1.2177
Offset	42.204
ADC Max	4096
Measurement Range	0 – 2500 mA

7. Dimensions (mm)

Dimensions shown (top view):
- 210.0
- 175.5
- 136.4
- Ø6.35
- (2) M6-1.0
- 96.0
- 151.7
- 48.0

Dimensions shown (side view):
- 232.6
- 44.4
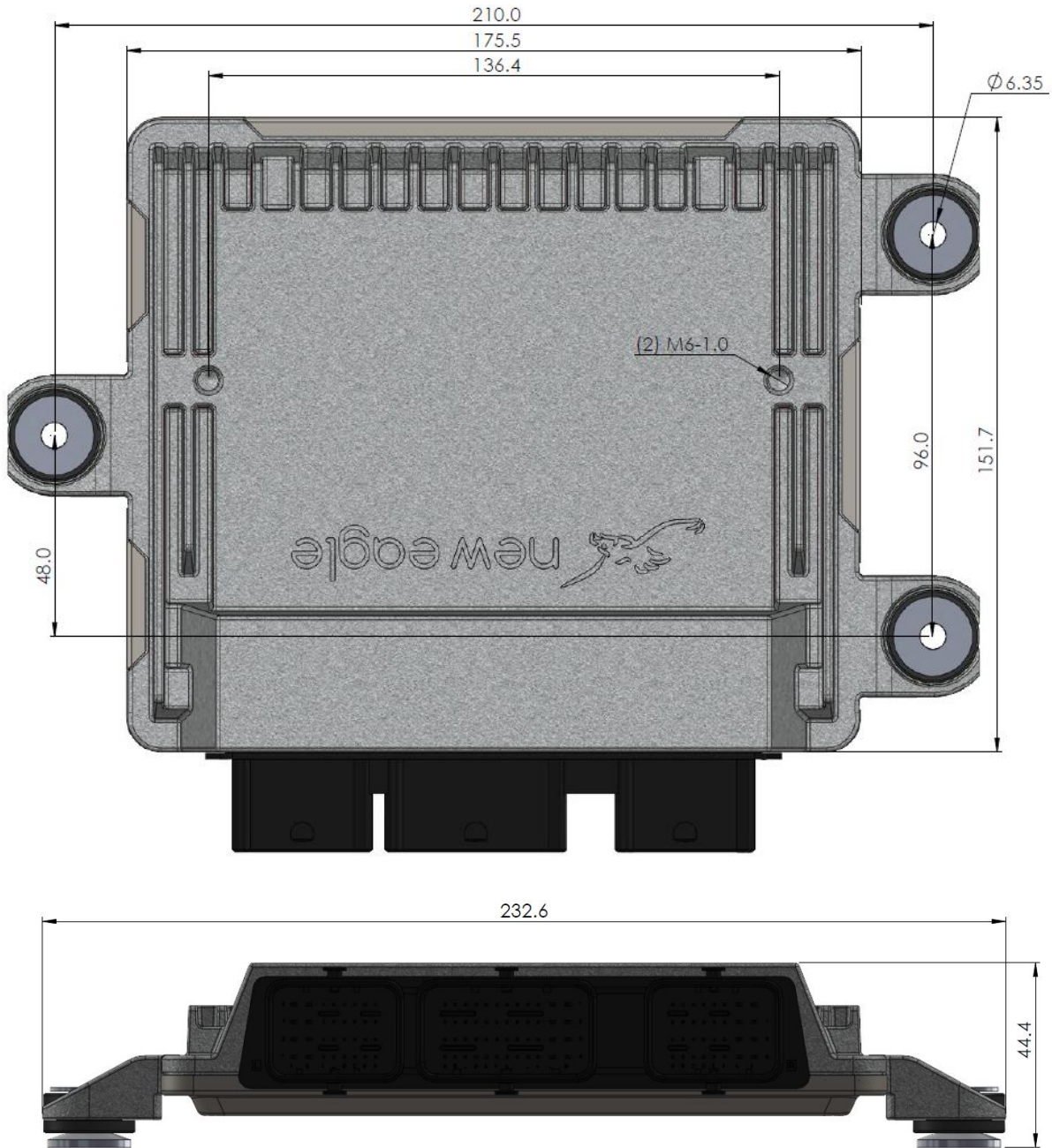
8. Connections and Pinout

The RCM112-2202 has 3 Connectors, as follows:
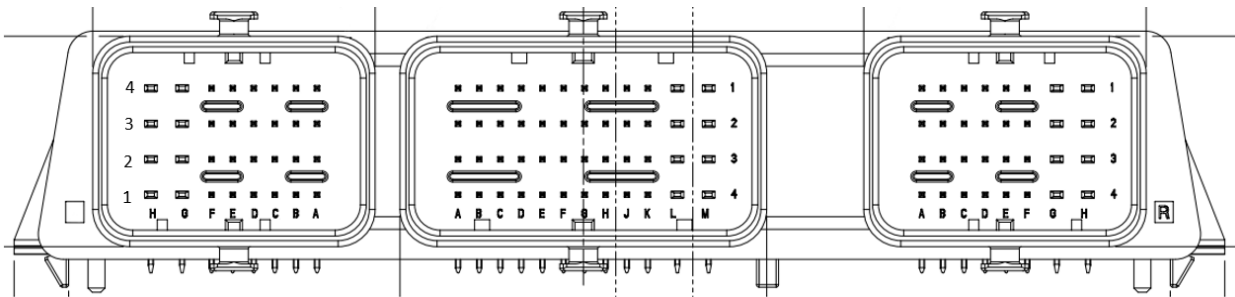
CONNECTOR J1   **CONNECTOR J2**   **CONNECTOR J3**

Connector J1(Gray Key): 0643191218			
Pin #	Pin Name	Pin #	Pin Name
J1-A1	AN28	J1-E1	AN12
J1-A2	AN29	J1-E2	AN13
J1-A3	AN30	J1-E3	AN14
J1-A4	SENSOR_GND	J1-E4	AN5
J1-B1	AN25	J1-F1	AN9
J1-B2	AN26	J1-F2	AN10
J1-B3	AN27	J1-F3	AN11
J1-B4	AN8	J1-F4	AN4
J1-C1	AN22	**J1-G1**	**SENSOR_GND**
J1-C2	AN23	**J1-G2**	**AN1**
J1-C3	AN24	**J1-G3**	**AN2**
J1-C4	AN7	**J1-G4**	**AN3**
J1-D1	AN15	**J1-H1**	**SENSOR_POWER_A**
J1-D2	AN20	**J1-H2**	**SENSOR_POWER_B**
J1-D3	AN21	**J1-H3**	**SENSOR_POWER_C**
J1-D4	AN6	**J1-H4**	**SENSOR_POWER_D**

Note: Pins A1-F4 typically utilize 20AWG Wire (Recommended PN: WM20 TXL series)

Note: Pins G1-H4 typically utilize 18AWG Wire (Recommended PN: WM18 TXL series)

Connector J2 (Brown Key): 0643203319

Pin #	Pin Name	Pin #	Pin Name
J2-A1	LSO13	J2-G1	LSO7
J2-A2	LSO14	J2-G2	DG9 | VR9 In
J2-A3	LSO15	J2-G3	CAN3+
J2-A4	LSO16	J2-G4	CAN3-
J2-B1	LSO12	J2-H1	LSO6
J2-B2	LIN1	J2-H2	DG10 | VR10 In
J2-B3	AN17 | SENT2	J2-H3	CAN4+
J2-B4	AN16 | SENT1	J2-H4	CAN4-
J2-C1	LSO11	J2-J1	LSO5
J2-C2	LIN2	J2-J2	DG8
J2-C3	AN19 | SENT4	J2-J3	DG7
J2-C4	AN18 | SENT3	J2-J4	HSO14
J2-D1	LSO10	J2-K1	LSO4
J2-D2	SENSOR_GND	J2-K2	LSO3
J2-D3	ETH+	J2-K3	HSO16
J2-D4	ETH-	J2-K4	HSO15
J2-E1	LSO9	**J2-L1**	**LSO2**
J2-E2	DG11	**J2-L2**	**LSO1**
J2-E3	CAN1+	**J2-L3**	**DRVP**
J2-E4	CAN1-	**J2-L4**	**GND**
J2-F1	LSO8	**J2-M1**	**DRVP**
J2-F2	DG12	**J2-M2**	**DRVP**
J2-F3	CAN2+	**J2-M3**	**DRVP**
J2-F4	CAN2-	**J2-M4**	**GND**

Note: Pins A1-K4 typically utilize 20AWG Wire (Recommended PN: WM20 TXL series)

Note: Pins L1-M4 typically utilize 18AWG Wire (Recommended PN: WM18 TXL series)

*Note: Green Cells Indicate Required for Minimum Programming

Connector J3 (Black Key): 0643193211			
Pin #	Pin Name	Pin #	Pin Name
J3-A1	HSO8	J3-E1	HSO4
J3-A2	HSO9	J3-E2	DG2
J3-A3	HSO10	J3-E3	DG1
J3-A4	VBAT	J3-E4	HSO13
J3-B1	HSO7	J3-F1	HSO3
J3-B2	DG6	J3-F2	HSO2
J3-B3	WAKE_INPUT1	J3-F3	CAN5-
J3-B4	MPRD	J3-F4	CAN5+
J3-C1	HSO6	**J3-G1**	**HSO1**
J3-C2	GND	**J3-G2**	**GND**
J3-C3	DG5	**J3-G3**	**GND**
J3-C4	HSO11	**J3-G4**	**GND**
J3-D1	HSO5	**J3-H1**	**HBD**
J3-D2	DG4	**J3-H2**	**HBC**
J3-D3	DG3	**J3-H3**	**HBB**
J3-D4	HSO12	**J3-H4**	**HBA**

Note: Pins A1-F4 typically utilize 20AWG Wire (Recommended PN: WM20 TXL series)

Note: Pins G1-H4 typically utilize 18AWG Wire (Recommended PN: WM18 TXL series)

*Note: Green Cells Indicate Required for Minimum Programming

9. Related Products

Part	New Eagle Store Part Number
CONNECTOR KIT – RCM112-2202	CON-KIT-RCM112-2202
HARNESS – RCM112-2202 PIGTAIL 12 FT	HARN-RCM112-2202-003
HARNESS – RCM112-2202 Minimum Programming*	HARN-RCM112-2202-001
ASSEMBLY: BREAKOUT BOX – RCM112-2202	ASM-BBOX-RCM112-2202

10. Environmental Ratings

Condition	Notes
This RCM is designed for automotive, under hood and marine industry environmental requirements. Validation tests include extreme operating temperatures, thermal shock, humidity, salt spray, salt fog, immersion, fluid resistance, mechanical shock, and vibration. EMC Tests include ISO7637-2 pulses, BCI, Radiated and Conducted Emissions, Battery Voltages, Short to Battery/Short to Ground, and ESD. The customer must contact New Eagle and provide the intended environmental conditions in the application for verification of performance capability.	
Storage Temperature	−40 °C to +125 °C
Operating Temperature	−40 °C to +105 °C
Thermal Shock	SAE J1455, section 4.1.3.2 −40 °C to +125 °C, 500 Cycles
Fluid Resistance	Two-stroke motor oil, four-stroke motor oil, unleaded gasoline, ASTM Reference 'C' fuel
Humidity Resistance	SAE J1455; section 4.3.3.2 90% Humidity at 85°C for 1000 Hours
Salt Fog Resistance	SAE J1455; section 4.3.3.2 500 Hours, 5% Salt Fog @ 35°C
Immersion	SAE J1455; section 4.3.3.2 4.34 psi test (simulated 3m / 10ft), salt water, 20 min
Mechanical Shock	MIL-STD 810F, Method 516.5, Procedure I 50 G's, 11 ms, half-sine wave, 4 shocks per direction.
Drop Test	6 drops on concrete from 1m, no hidden damage
Vibration	MIL-STD-810C Method 514.2
ISO7637-2 Pulses	Pulse1, 1B, 2A, 2B, 3A, 3B, 5B, and Waveforms A1, and A2
ISO16750-2 Pulse	Section 4.6.4 Test A: Pulse 5B De-Centralized Load Dump Section 4.6.4 Test B: Pulse 5B Centralized Load Dump
BCI	ISO 11452-4
Radiated and Conducted Emissions	CISPR25
Battery Voltages	8-32V Steady State, 5.5V minimum operating voltage, 38V Max Overvoltage
Reverse Battery	-32V for up to 5 minutes.
Short to Battery/Short to Ground	All pins can tolerate short to battery and short to ground connections
ESD	Up to 4kV Handling, up to 15kV Operating

11. Production Warranty Approval Process

New Eagle does not warranty prototype or development ECUs based on the information supplied in this datasheet. Production applications using this hardware require application review by New Eagle Engineering prior before production warranty coverage can be granted. Typically, this review is performed as part of the Production Supply Agreement and involves a review of the application's operating mode, environmental conditions, and I/O usage details to assure that the application is utilizing the hardware within its design specifications. Involving New Eagle's Application Engineering team early can help to expedite the approval process.