Procyon MotorDriverV1.0 Manual

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1. MotorDriverV1.0 Overview

The MotorDriverV1.0 board is a high-power dual H-bridge capable of independently driving 2 DC motors or one stepper motor. The driver is based on the LMD18200 H-bridge IC from National Semiconductor and can operate at supply voltages of 12 volts to 50 volts, and motor currents up to 3 amps continuous and 6 amps peak. Pulse width modulation (PWM) can be used to achieve variable motor speeds and powers. An electro-motive brake function is available and when activated will slow motor rotation by electronically shorting the motor leads.

Each motor driver accepts three logic-level (0-5V) control signals: PWM, DIR, and BRAKE. The PWM input controls the power applied to the motor. The DIR input controls the polarity of the applied output and hence the direction of rotation for a DC motor. The BRAKE allows the motor to be slowed by shorting the motor's induced field.

Each motor driver outputs two signals: ISENSE and TFLAG. ISENSE is an analog voltage representing the current being delivered to the motor at any given time. The scale of this voltage is (377uA/A*4.7K) = 1.77V/A (that's 1.77 volts output for every amp of motor current). Also available is a TFLAG output indicating when the case temperature of the motor driver chip exceeds 145ºC.

Connection is made to all control and monitoring signals via three 10-pin headers. These headers are designed to be highly compatible with the AVRmini development board, Atmel's STK500, as well as being suitable for general-purpose use.

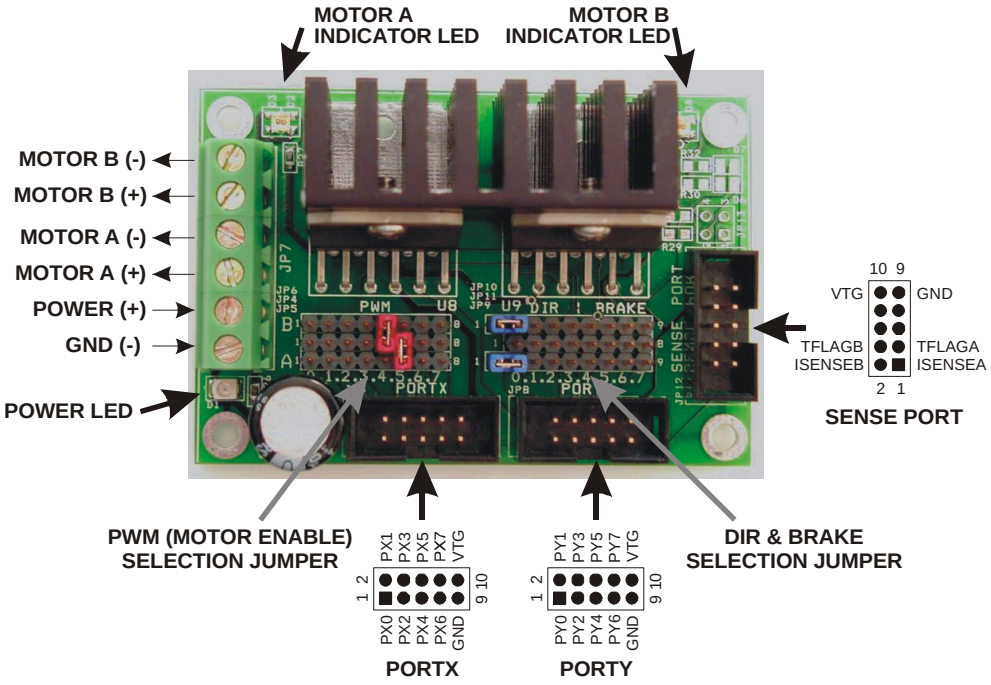
NOTE: The LMD18200 driver requires a minimum of ~10V to operate. At supply voltages less than 10V, the driver outputs do not energize.

2. MotorDriverV1.0 Features and Specifications

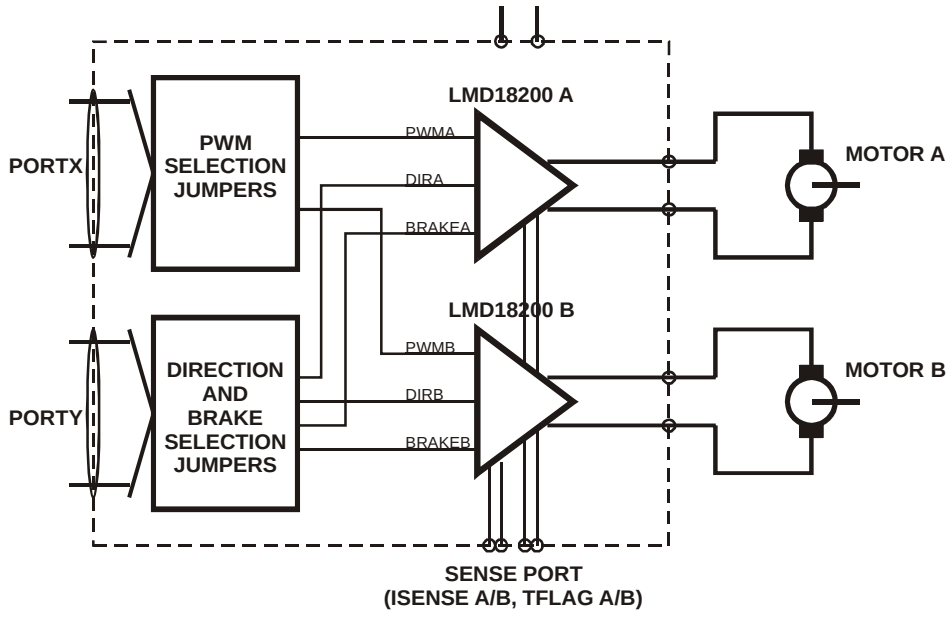
- **Dual LMD18200 H-Bridge Motor Drivers (12V-50VDC, 3A cont, 6A peak)**
- **PWM, Direction, and Brake Inputs** (via PORTX,Y 10-pin Headers)
- **Motor Current Sense and Thermal Flag Output** (via SENSE 10-pin Header)
  (All port headers match pin-out used by AVRmini and STK500)
- **Jumper Configuration of PWM, Dir, and Brake Input Pins**
- **Motor Output LED Indicators**
- **DC Power Supply LED Indicator**
- **Screw Terminals for Power Input and Motor Output**
- **Heatsink for LMD18200 Driver ICs**
- **Small Board Size (3"x2")**

3. Board Reference

3.1. Parts, Connectors, and Terminals



3.2. Block Diagram



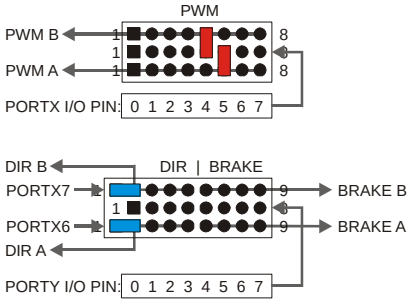
3.3. The PWM and DIR/BRAKE Selection Jumpers

The PWM selection jumpers allow the user to easily connect the PWMA and PWMB motor driver inputs to any two pins of PORTX. The DIR/BRAKE selection jumpers provide a similar function, allowing DIRA/B and BRAKEA/B to be connected to pins of PORTY. The table below lists the possible combinations for reference.

Control Signal	Possible Connections
PWMA	Any PORTX I/O Pin
PWMB	Any PORTX I/O Pin
DIRA	PORTX Pin 6, or any of PORTY I/O Pins 0-3
DIRB	PORTX Pin 7, or any of PORTY I/O Pins 0-3
BRAKEA	Any of PORTY I/O Pins 4-7
BRAKEB	Any of PORTY I/O Pins 4-7

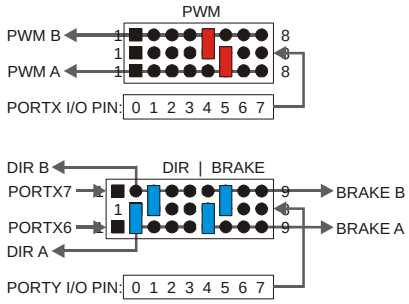
An example configuration: On many AVR processors, Pulse Width Modulation (PWM) output is available on PORTD pins 4 and 5. To connect these signals to the motor driver, a 10-pin ribbon cable can be used to connect the AVR board's PORTD to the motor driver board's PORTX. Since we know the processor's PWM output is on pins 4 and 5, we can place the PWM selection jumpers to connect PORTX5 to motor driver input PWMA and PORTX4 to input PWMB, for example. If we also want Direction control to come from PORTD, we can use the DIR/BRAKE jumpers to connect PORTX Pins 6 and 7 to the DIR inputs of the motor drivers. This configuration is shown in the table below and in the photo in section 3.1 of this manual. This setup is popular because it allows control of the speed and direction of two motors from only 4 pins of one I/O port.

Example PWM and DIR/BRAKE Selection Jumper Settings



PWMA = PORTX I/O Pin 5
PWMB = PORTX I/O Pin 4
DIRA = PORTX I/O Pin 6
DIRB = PORTX I/O Pin 7
BRAKEA/B Unconnected

* This configuration is common when the user would like to control PWM and Direction of both motors from only one 10-pin I/O port, PORTX.



PWMA = PORTX I/O Pin 5
PWMB = PORTX I/O Pin 4
DIRA = PORTY I/O Pin 0
DIRB = PORTY I/O Pin 1
BRAKEA = PORTY I/O Pin 4
BRAKEB = PORTY I/O Pin 5

4. Control Signal Reference

The table below describes the input and output control signals to and from the motor drivers in more detail. For additional information, consult the datasheet for the LMD18200T driver chip from National Semiconductor (www.national.com).

Input Signals	**Description**
PWM A/B	L = Motor driver is effectively disconnected from the motor H = Motor driver is energized, applying power to the motor
DIR A/B	L = Motor output is reversed (motor +/- connects to power -/+) H = Motor output is normal (motor +/- connects to power +/-)
BRAKE A/B	L = Brake is inactive H = Brake is active (motor leads are shorted by the driver)
Output Signals	**Description**
ISENSE A/B	Output voltage is 1.77V per amp of motor current
TFLAG A/B	L = Motor driver temperature is less than or equal to 145ºC H = Motor driver temperature is greater than 145ºC

5. Application Notes

Some words of advice for beginning motor driver users:

- Motor current is directly proportional to mechanical output torque ($I = K_T * T$).
- When measuring motor current, you must make the measurement under the same mechanical load that will be experienced in the final application/machine/robot. A motor than consumes 100mA when unloaded may require several amps when a heavy mechanical load is applied.
- When a motor's shaft and any attached mechanism is accelerating, it will require more current because acceleration requires extra torque. Beware of motor current spikes when accelerating suddenly (going from a stop to full speed, full speed to a stop, or worse, reversing direction at full speed). These spikes can often be **10x** the normal operating current of the motor, and may exceed the 6A peak rating of the motor driver.
- If current spikes due to acceleration are a problem, consider using PWM control to accelerate the motor more slowly. Slower acceleration requires less current. When reversing directions on a motor running at full power, consider turning the motor off briefly to allow it to slow down before switching the DIR line and reapplying power in the opposite direction.
- This motor driver is capable of handling large amounts of power. If overloaded, even for a moment, a **catastrophic driver failure may result and cause a minor explosion or a significant fire**. This is not a joke, 4" flames have been seen shooting out of a LMD18200 just after a major overload.