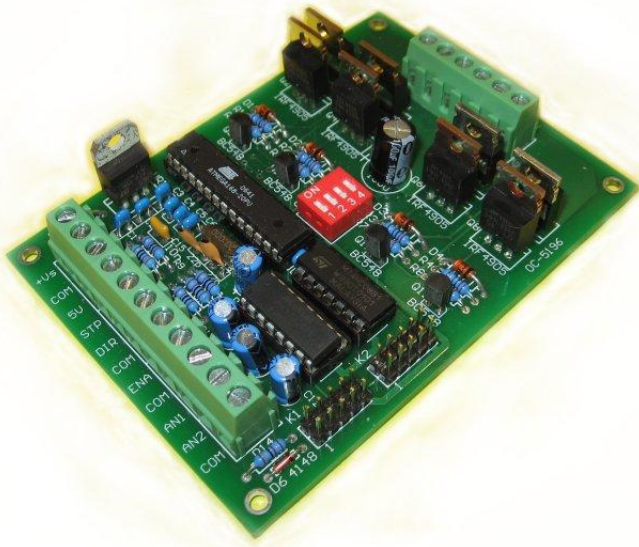


Ocean Controls KT-5198 Dual Bidirectional DC Motor Speed Controller



- Microcontroller Based
- Controls 2 DC Motors
- 0-5V Analog, 1-2mS pulse or Serial Inputs for Motor Speed
- 10KHz, 1.25KHz or 156Hz selectable PWM Frequency
- High Quality Through Plated Dual Layer PCB
- Screw Terminals for all Connections
- Enable Input Removes Current From Motors when Pulled Low
- Options Selectable by DIL Switches
- Controls Motors up to 6A

Based on the circuit of the KT-5196 Stepper Motor Controller, the KT-5198 Dual Bidirectional DC Motor Speed Controller allows a user to control the speed of up to two DC Motors independently, using an analog 0-5V signal, potentiometers, serial port of a PC or 1-2mS RC Pulse.

Modes of Operation:

The KT-5198 can be operated in serial, analog or pulse mode. In analog and pulse modes each motor can be operated in unidirectional mode with the 0-5V analog input (or 1-2mS pulse) giving 0-100% PWM and a digital input for direction selection, or in bidirectional mode where the analog or pulse input is responsible for both direction and speed selection.

In bidirectional mode 2.5V (or 1.5mS pulse) will give 0% PWM duty, increasing voltage from 2.5V to 5V (or pulses from 1.5 to 2mS) will increase the PWM duty from 0-100% and turn the motor in one direction. Decreasing the voltage from 2.5V to 0V (or pulses from 1.5 to 1mS) will increase the PWM duty from 0-100% and turn the motor in the other direction.

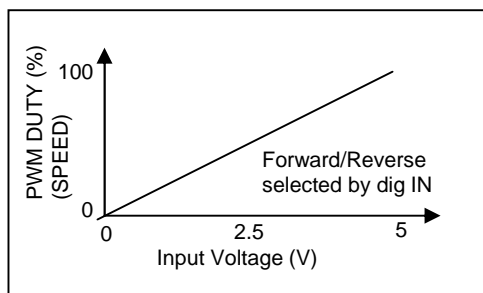


Figure 1A - Unidirectional Mode

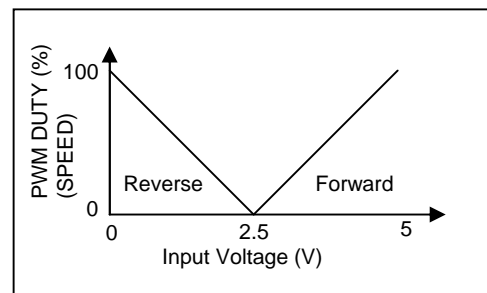


Figure 1B - Bidirectional Mode

Figure 1A shows how the input voltage affects the motor speed when the driver is in Unidirectional Mode, with a digital input selecting motor direction and Figure 1B shows how the input voltage affects motor speed and direction in Bidirectional Mode.

Unidirectional mode requires a digital input to select motor direction. For Motor 1 the input is STP and for Motor 2 the input is DIR. When the input is connected to, or disconnected from COM when the analog input is close to 0V the motor will change direction. Motor direction can only be changed when the analog input is close to 0V because reversing motor direction while the motor is turning could have damaging effects on the motor and KT-5198.

In serial mode commands are sent over the serial port to set each of the motors speeds

Mode Selection:

The DIL Switches in the centre of the PCB are used to select the operation mode for each motor. Refer to Table 1 to see how each switch settings affect controller operation. The switch labeled 1 will put Motor 1 in Unidirectional mode when it is switched ON or in Bidirectional mode when it is switched OFF, the switch labeled 2 will put Motor 2 in Unidirectional mode when it is switched ON or in Bidirectional mode when it is switched OFF. Switch 3 will put the controller in 1-2mS RC Pulse mode when turned ON and 0-5V Analog mode when turned OFF. Switch 4 determines whether the controller is in Serial Mode or not. When switch 4 is ON the controller will only respond to serial commands, in serial mode switches 1 and 2 determine the serial address of the controller.

Table 1 - Mode Selection

Sw1	Sw2	Sw3	Sw4	Mode
OFF	OFF	OFF	OFF	M1 and M2 Bidirectional, 0-5V Input
ON	OFF	OFF	OFF	M1 Unidirectional, M2 Bidirectional, 0-5V Input
OFF	ON	OFF	OFF	M1 Bidirectional, M2 Unidirectional, 0-5V Input
ON	ON	OFF	OFF	M1 and M2 Unidirectional, 0-5V Input
OFF	OFF	ON	OFF	M1 and M2 Bidirectional, 1-2mS Pulse Input
ON	OFF	ON	OFF	M1 Unidirectional, M2 Bidirectional, 1-2mS Pulse Input
OFF	ON	ON	OFF	M1 Bidirectional, M2 Unidirectional, 1-2mS Pulse Input
ON	ON	ON	OFF	M1 and M2 Unidirectional, 1-2mS Pulse Input
OFF	OFF	X	ON	Serial Input Address 00
ON	OFF	X	ON	Serial Input Address 01
OFF	ON	X	ON	Serial Input Address 02
ON	ON	X	ON	Serial Input Address 03

Serial Commands:

When the controller is in Serial Mode (by turning switch 4 ON) it will only react to valid commands sent via the serial port. Connect a PC to the controller using a straight through serial cable. The controller communicates using 9600 Baud, 8 Data Bits, No Parity and 1 Stop Bit (9600 8N1). Multiple controllers can be connected to one PC by using an optional connector cable to connect controllers together. When more than one controller is connected to the same port on the PC ensure that the address of each is set differently. Up to four controllers can be controlled from the one serial port. Serial commands are in the form

@AA CMND XXXX

and are terminated with the Carriage Return (CR) and Line Feed (LF) Characters.

AA is the Address, as set by switches 1 and 2 (See Table 1).

CMND is the four letter Command. Valid commands are shown in Table 2.

XXXX is the Parameter. Each command has a valid parameter range, as shown in Table 2.

Table 2 - Serial Commands

Command	Params	Description
M1SP	-1023 to 1023	Motor 1 Setpoint, Less than 0 is REV, Greater than 0 is FWD
M1AI	1 to 1023	Motor 1 Acceleration Increment
M2SP	-1023 to 1023	Motor 2 Setpoint, Less than 0 is REV, Greater than 0 is FWD
M2AI	1 to 1023	Motor 2 Acceleration Increment
TIME	Greater than 0	Time Step which is used when Accelerating and Decelerating
SPWM	1,2 or 3	PWM Frequency. 1=10KHz, 2=1.25KHz, 3=156Hz
SAVE	None	Saves all parameters to EEPROM

The provided VB program can also be used to control the motors using a graphical interface. Source code is also provided so that the program can be modified to meet your own requirements.

Connections:

Label	Description
+Vs	Logic Power Supply Positive Input (8-26)VDC
COM	Common (Ground) Connection and Power Supply Negative Input
5V	5VDC Output
STP	Motor 1 Direction Digital Input (Enabled when pulled to COM)
DIR	Motor 2 Direction Digital Input (Enabled when pulled to COM)
COM	Common (Ground) Connection
ENA	Enable/Disable Input Low Level removes current from Motors
COM	Common (Ground) Connection
AN1	Motor 1 Analog/RC Pulse Speed Control Input
AN2	Motor 1 Analog/RC Pulse Speed Control Input
COM	Common (Ground) Connection
M1	Motor 1 Connection
M1	Motor 1 Connection
V+	Motor Power Supply Input 5-50VDC
COM	Common (Ground) Connection
M2	Motor 2 Connection
M2	Motor 2 Connection

How to use the Driver:

Using the Wiring Diagram as a guide, connect 12VDC (or anything between 8VDC and 26VDC) positive to the +Vs (Not the V+) terminal connect the 12VDC negative to the COM terminal closest to the +Vs terminal.

If you are going to use Analog mode, connect a potentiometer between the 5V and COM terminals and connect the wiper to the AN1 (or AN2) terminal. Alternatively connect any 0-5V analog signal to the AN1 (or AN2) terminal.

If you are going to use an RC pulse, connect the pulse input to the AN1 (or AN2) terminal and connect the common of the device providing the RC Pulse to the COM terminal.

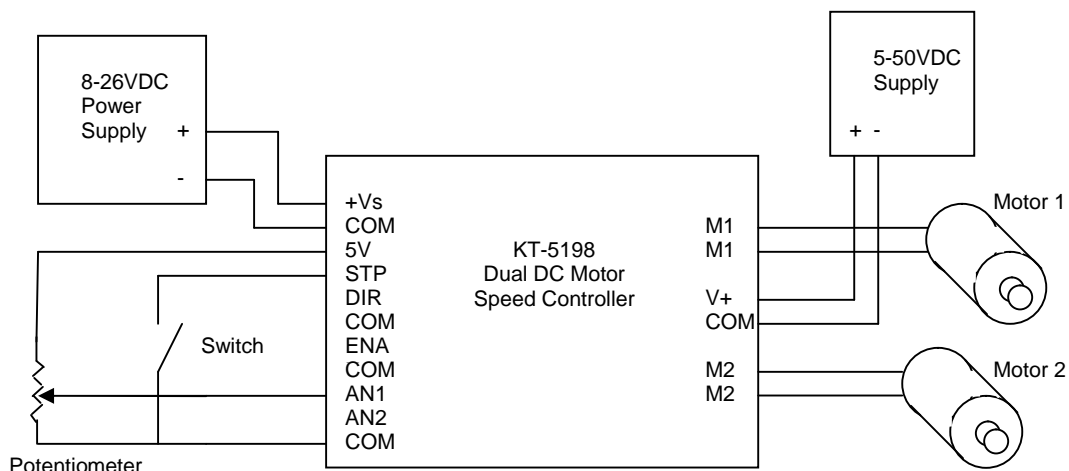
If you are using the Motors in Unidirectional mode then a Normally Open (NO) switch connected between STP and COM will control the direction of Motor 1 and a NO switch connected between DIR and COM will control the direction of Motor 2.

A safety switch can be connected between ENA and COM, when it closes the motors will be disabled. Connect Motor 1 between the M1 connections and Motor 2 between the M2 terminals.

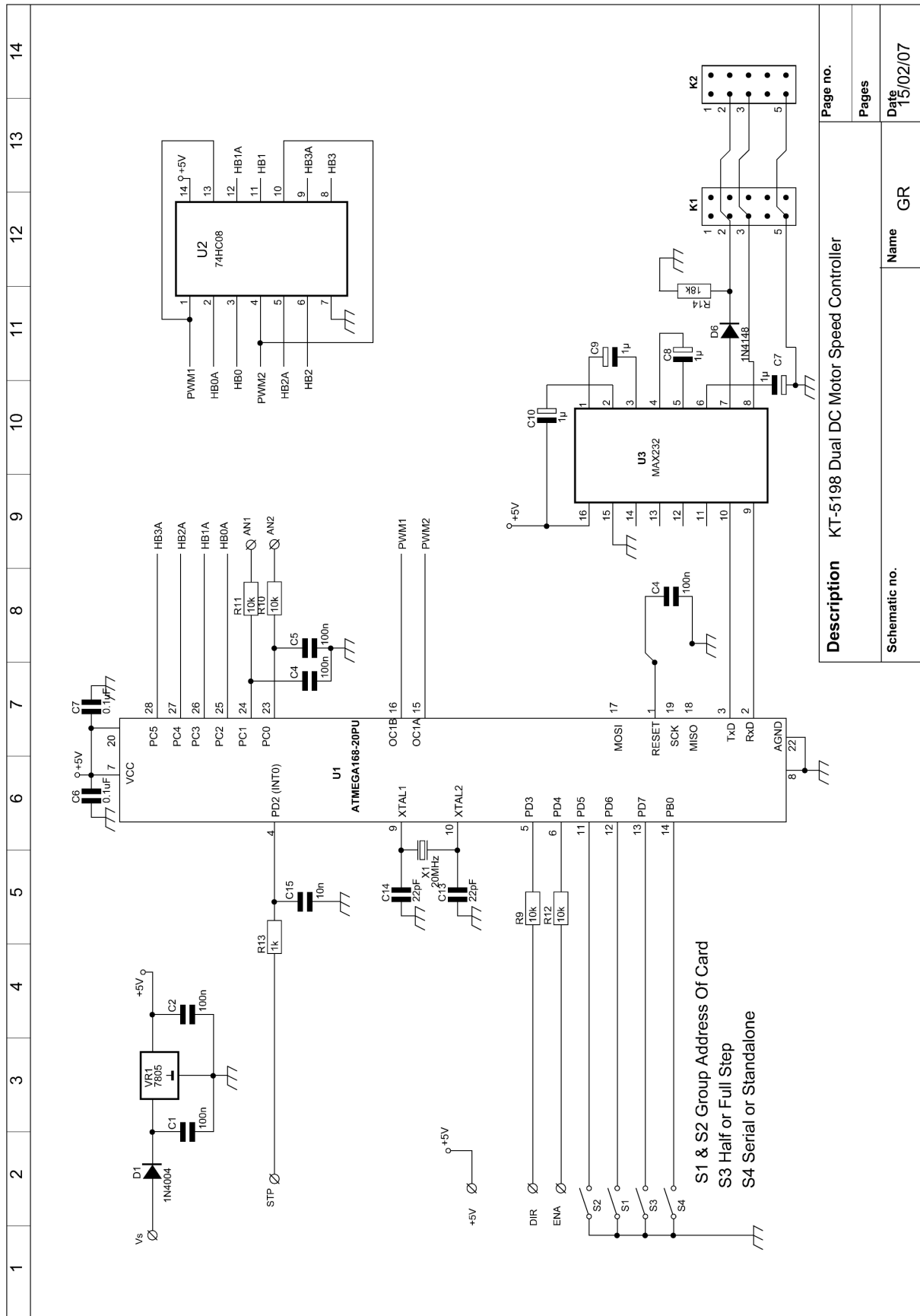
Connect the motor power supply positive to the V+ terminal and the Negative to the COM terminal closest to the V+ terminal.

With DIL switch 1 in the ON position turning the potentiometer will increase and decrease motor speed and the switch will change motor direction when the motor is stopped. When the DIL switch is in the OFF position set the potentiometer to approximately half way. When the potentiometer is turned in one direction the motor will increase in speed in one direction and when the potentiometer is turned in the opposite direction the motor will slow down and then speed up in the opposite direction.

Wiring Diagram:

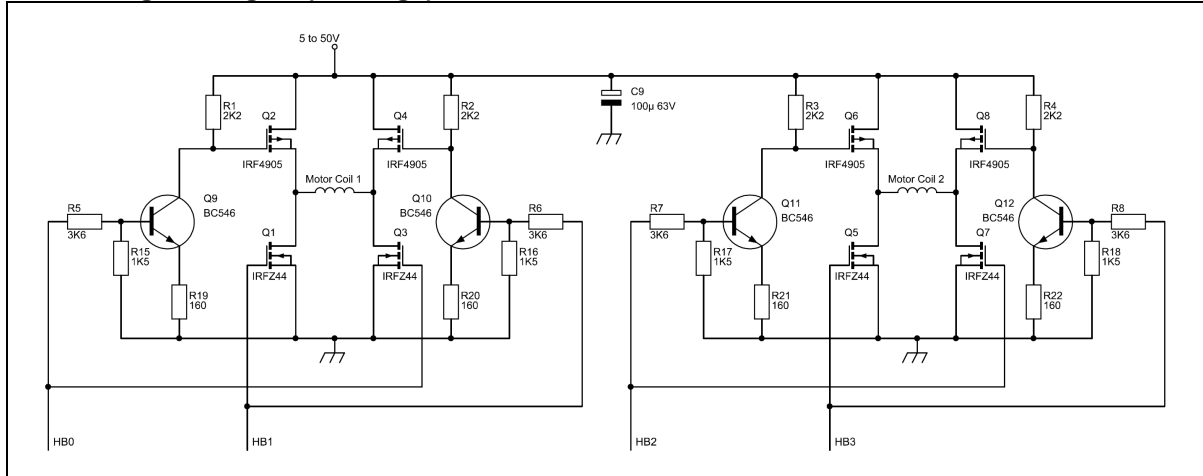


Circuit Diagram:



Description KT-5198 Dual DC Motor Speed Controller	Page no.
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Circuit Diagram Page 2 (H-Bridge):



Heat:

It is recommended that you monitor the heat output of the FET's on the KT-5198 for the first few minutes, if you are using a motor which draws more than 2A of current. If you notice the FET's getting too hot you may need to use a heatsink (such as a drilled piece of aluminium) and fan to dissipate the heat.

You will need to use insulating bushes and washers to ensure that there is no electrical connection between any of the FET's as they do not sit at the same potential.

Parts List:

Part	Designator	Quantity
160 Ohm Resistor	R19-R22	4
1K Resistor	R13	1
1K5 Resistor	R15-R18	4
2K2 Resistor	R1-R4	4
3K6 Resistor	R5-R8	4
10K Resistor	R9-R12	4
18K Resistor	R14	1
1N4004 Diode	D5	1
1N4148 Diode	D6	1
22pF Capacitor Ceramic	C13, C14	2
10nF Capacitor Monolithic	C15	1
0.1µF Capacitor Monolithic	C1-C8	8
1µF Capacitor Electrolytic	C9-C12	4
100µF 63V Capacitor Electrolytic	C16	1
BC546 NPN Transistor	Q9-Q12	4
IRFZ44N N-Channel MOSFET	Q1, Q3, Q5, Q7	4
IRF4905 P-Channel MOSFET	Q2, Q4, Q6, Q8	4
7805 5V Regulator	VR1	1
4-way DIP Switch		1
3-way Terminal Block	T4-T6	3
2-way Terminal Block	T1-T3, T7	4
28-pin Narrow IC Socket	U1	1
14-pin IC Socket	U2	1
16-pin IC Socket	U3	1
20MHz Low Profile Crystal	X1	1
ATMega168 IC Programmed	U1	1
74HC08	U2	1
MAX232	U3	1
10-pin IDC Header (2x5pins)	K1, K2	2
D9 Female IDC socket		1
10-pin IDC Header Connector		1
9-wire IDC Ribbon		120mm