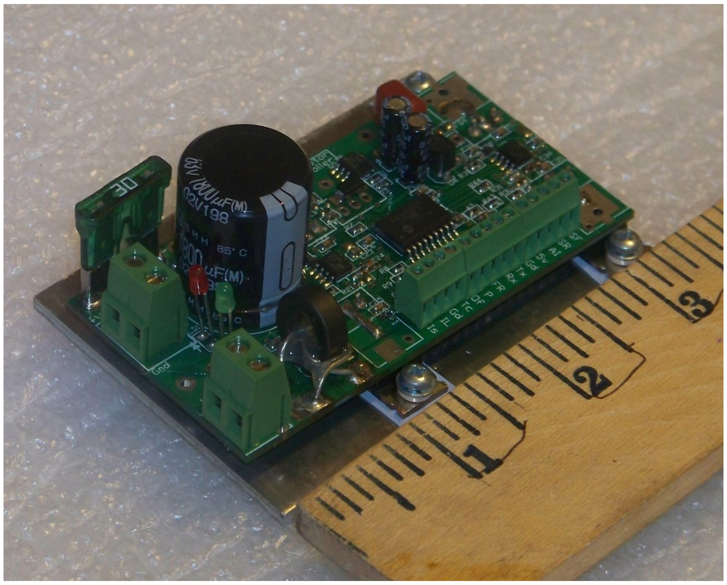
DeviceCraft

Revision #2 6/1/2012



H-Bridge DC Motor Driver / Speed Controller

P/N 1015A 30Amps (~15 Amps for 180v version)

Available with power supply voltages 18v, 50v, 90v, 180v standard is 50v

Features:

- High power discrete MOSFET construction
- Analog Forward/Reverse input speed control (0 to 5Volt, 1 to 4v, PCM, TTL RS232)
- Screw terminal connections and onboard Blade fuse.
- Nonvolatile EEprom storage of parameters
- Synchronous operation(diodes are not used for conduction except during transitions)
- Differential motor current sensing and ~20usec over current protection
- High Power Discrete MOSFET H-Bridge configuration
- On board regulator with a +5v regulated output for powering circuitry
- Thermistor based over temperature protection
- Ultra Quiet ~15Khz Pulse Width Modulation 99+% Duty cycle
- Led indicators for normal and fault condition
- Conservative Current specifications
- Over/Under voltage protection
- Shut down feature
- Forward and Reverse stop

- Isolated Aluminum mounting plate
- IR compensation (optional auto increase current with higher load)
- Power supply, current, I/O lines readable from RS232 connections
- Addressable units for up to 9 units for 1 serial port line
- Low drop out regulator for operation down to ~9.5V
- Active current(torque) or duty cycle(voltage) control.
- 10bit duty cycle resolution
- Plate Size: 3.5” x 2.5” (inches) , Height ~1.5 inches (depends on capacitor)

Illustration 2: USB to TTL RS232 SERIAL Cable2

Note a USB to RS232 TTL serial cable is required to setup the parameters such as acceleration and mode but, is not needed after configuration is complete.

Applications:

- Simple DC brush motor control
- Torque controller for valves
- Microscope axis movement
- Pump controllers
- Exercise equipment
- Machine automation
- Robots

Description

The H-Bridge DC motor controller consist of 4 power MOSFETs, 2 high side/low side MOSFET drivers, hall effect high side current sensor, step down regulator circuitry, micro-controller, blade fuse, mounting plate, thermistor, and miscellaneous capacitors, diodes, resistors, and connectors.

Speed control is achieved by pulse width modulating the power supply voltage. The pulse width modulator allows the motor speed to be controlled without changing the power supply voltage. The H-Bridge configuration allows the polarity of the voltage to be reversed without reversing the power supply leads. The reversing is fully solid state and allows the rate of direction change to be controlled. If reversing is not needed the reversing can still be used to quickly drive the motor to a stop.

The on board re-programmable micro controller allows for various configurations. The micro-controller controls all switching operations, monitors faults, controls acceleration, dead times, and can be quickly reprogrammed to suit individual applications. The unit can be customized for various interfaces such as single speed control line or forward and reverse controlled separately.

Specifications for (P/N 1015)

Operating Voltage	9V to 180V (depends on MOSFETS)
Current Limit Setting	~40Amps
Over Current Response Time	~6us
Over Temperature On	80C
Over Temperature Off	70C
Startup Time	~1Sec
Ramp Rate (stop to full speed)	~0 to 4Sec depends on settings
Duty Cycle	0 to ~99.9%
PWM switching rate	~15 Khz
Digital Input low	Below 2.5V not digital, measured with ADC
Digital Input High	Above 2.5V not digital, measured with ADC
Quiescent Current Note: Hall effect current sensor draws 10mA Green LED draws 3ma	~16mA
MOSFET On resistance	depends on MOSFETS
Reversing Delay Time	0 sec

Input/Output Pins for Model 1015:

Pin	Name	Function
1	Is	Current monitor output. No current 2.5v increases with increasing current. 1 hall effect turn 20mv/Amp 2 hall effect turn 40 mv/Amp
2	IL	Analog input (0v to 5v) Selects max current 50K(R8) to 5v 100(R10) ohm input resistor 1uF(C7) to gnd capacitor for filter Option 50k to gnd R9
3	Gnd	Ground output for powering potentiometers
4	T/Coast	Thermistor voltage output Or pulling to ground will activate coast, during coast all MOSFETs are turned off.
5	Of	Applying 2v to 28v with shut down the unit leave open or gnd for normal operation
6	P	Programing pin, leave open or can be digital read with RS232 connection
7	F/R	Digital Input Forward/Reverse selection 0v reverse 5v forward 50k Pull up to 5v on board 100ohm 1uf input filter This is actually read by ADC, below 2.5v is low above 2.5v is high.
8	Rx	RS232 receive input 50k pullup to 5v
9	Tx	RS232 transmit output 50k pullup to 5v
10	Gnd	2nd ground line for powering external circuit
11	+5v	+5v DC output Only a small <10ma of current should be drawn from this pin for powering potentiometers and hall effect throttles.
12	AI	Analog input (0v to 5v) Selects max current 50K(R41) to 5v 50k (R42) to Gnd 100(R40) ohm input resistor 1uF(C9) to gnd capacitor for filter
13	SR	Stop reverse input. Normally high with pullup resistor on board, pull to ground to stop Can be read with RS232 line.
14	SF	Stop forward input. Normally high with pullup resistor on board, pull to ground to stop Can be read with RS232 line

LED indicators:

1) Green LED
   - A) Continuously ON – normal operation
   - B) Off during shutdown or no power
2) Red LED.
   - A) Flash 1 second interval – Over temperature active
   - B) Flash ¼ second interval – Over Current active
   - C) Flash 1/2 second interval – Over or Under voltage

Acceleration

The acceleration is controllable from 0 seconds to many ? seconds. A controlled acceleration reduces wear on the motor, gears, and power source. A controlled acceleration can prevent the over current protection circuitry from triggering during start-up or reversing. The acceleration can be controlled by adjusting the the values stored the the micro controller nonvolatile Eeprom.

The acceleration values stored in the nonvolatile memory range from 1 to 30000. A value of 1 will produce the slowest acceleration and 30000 will produce the fastest.

For Normal ramp: 300

For fast current control: ~ 3000

Slow/Fast Decay

A H-Bridge can be operated in various synchronous modes. Slow decay seems to be the most popular for most applications. During slow decay the duty cycle is 0% at stop and 100% at full speed. With fast decay 0% is full reverse, 50% is stop, and 100% is full forward or the opposite. With fast decay large motors can experience large current draws at stop, be more demanding on the power supply decoupling capacitor, and have a uneven variable speed control. Fast decay can more quickly reverse a motor and the control logic maybe simpler.

In fast decay, motor current is feed back to the battery or decoupling capacitor. During fast decay, directing the current in the motor inductor to the voltage supply causes the motor inductor to decay much faster. Fast decay can be slightly noisier and cause excessive heating of the battery decoupling capacitor. Fast decay may require an extra low ESR electrolytic capacitor to avoid heating. Fast decay is best for fast small servo motor applications. Fast decay will not function for resistive loads such as a variable heater application.

During the off cycle slow decay circulates the motor current in the lower MOSFETs. The low voltage/low impedance appearing across the motor terminals creates a slow decay condition. During slow decay the motor inductor current will decay much slower allowing for a smoother current waveform. Slow decay must be used for variable power resistive load applications.

This unit currently only implements slow decay.

Shutdown

Shutdown mode will reduce the idle power supply current consumption. The shut down line is activated by applying 2v to 28v to the Of line, on the 14 pin connector. This shuts down the power to the unit. A series resistor can be place to lower the current into this pin. At voltages over 15V a series resistor is recommend (>50k). The unit typically draws ~.6mA during shut down. The high voltages units >30V will draw more depending on the value of the resistor/zener combination R1/Z1.

TC/Coast and Temperature Measurement

The motor controller has a TC/coast operation for most modes. This line can be used to measure the temperature of the unit or simulate a over temperature condition. During a over temperature condition the pulse width modulator is disabled and all MOSFETs in the H-Bridge are turned off. Turning off all MOSFETs initiates a coast where the motor experiences a open circuit condition. When the H-Bridge is disabled the motor current will decay in a fast decay mode where the current in the motor inductor is directed to the power supply and decoupling capacitor, i.e. regeneration. After the motor current decays down to zero the motor will spin freely. The regeneration only lasts for milliseconds and depends on motor speed and motor inductance.

The TC/Coast line can also be used to measure the temperature of the device. The thermistor on board is a 10k bead with a 10k ohm resistor to the 5v regulator. The output TC line is place at the junction. At 25C the thermistor is 10kohms resulting in (10k/(10k+10k))*5volts=2.5v output. As the temperature increases the thermistor will drop in resistance, at 90C the thermistor is about 1.5k resulting in a output voltage of (1.5k/(1.5k+10k)*5v=.65v. At cold the thermistor will increase drastically in value producing a output voltage up to 5v.

The over temperature protection trigger can also be modified. The temperature can also be measured with the TC line on the 14 pin connector or measuring with the RS232 port. When the over temperature is trip the RED led will flash at a 1Sec interval.

Ain input filtering

There is a Ain input filter. The filter filtering is controlled by R40,R41,R42 and C9 and any external potentiometer resistance.

Note: You may needed to remove R41(50k to 5v) or R42(50K to ground) for the correct open circuit voltage.

Over/Under Voltage

The motor controller will detect over and under voltage conditions on the power supply. Over voltage can occur during deceleration as the motor and controller regenerated sourcing current back to the power source. The over voltage can damage the power supply and motor controller. If the under or over voltage is reached the motor controller will temporary shut down and wait till the voltage condition is again in range. Over voltage is less of a fault with battery power sources.

Under voltage can also sensed. A under voltage can occur if the battery is depleted or the operator does not desire to have a battery be completely discharged. Apparently Lithium Ion batteries can be damaged if output voltage drops under a specified level.

The voltage is sensed with a resistor divider network R4/R5. There is also a filter capacitor C10(1uf). The divide ratio is about 1/51. The serial port command OVS and UVS will set the trigger levels in nonvolatile memory.

Example: 24volt trigger level.

24v/51 = .47v

10bit ADC 5v/2^10 = 4.89mv/bit

.47v/.00489 = 96.

serial command:

OVS 96

or

UVS 96

If the power supply is 24v then the over voltage will need to be set higher than 96 and the under voltage set lower than 96. Reading the power supply voltage with the VS? Command can establish a reference point.

Example:

OVS 120

UVS 80

Over Current Protection and Current Measurement:

The H-Bridge motor driver provides for over current protection. The current is sensed with a Hall Effect sensor located on the motor leads. The output of the Hall Effect current sensor also is routed to the 14 pin control connector. The normal 0 ampere output of the sensor is 2.5volts. With an increase in current the output increases. When in reverse or regenerating the voltage will decrease below 2.5volts. The current protection is hardware based and is always monitored. When an over current level is met, all the MOSFET switches in the H-Bridge are shut down (coast). In a case where the motor outputs are shorted the protection circuitry will shut down within about 10usec. The over current is monitored by the microprocessor and will normally reset in ½ a second. The RED will flash at ¼ second intervals.

The user may need to increase or decrease the over current protection level, the current configuration will trigger at about +/- 40Amps with one turn +/-20Amps for 2 turns. The over current protection may trigger during start-up or for high current pulsed application. The current level can be decreased by looping the wire through the circular core multiple times. The current trip levels are approximately 1v and 4v.

The current provided to the motor and be monitored the the unit. The current is a indication of the torque provided to the motor. The IS pin can be used to directly measure the current.

Illustration 1: Serial Output

When the ?; is execute the value return will be the actual hall effect current sensor output returned in bits.

IS2 is only for high power units with 2 sensors.

The IS(current sense range) is -511 to 511. This value is arrived by subtracting 2.5volt from the hall effect current sensor output.

The value of -96 may need to be converted to arrive at motor current. The analog to digital converter is 10 bits for 1024 values in the range of 5volts.

Current = 96 bits

96 bits * 4.88millivolts = 468mv (5volts /1024 = 4.88mv per bit)

The current sensor with 1 turn each side(2turns) is ~44mv/Amps

Current = 151mv/22mv = 10.64 Amps

A offset can be added to the current sensor readings. The IOF command sets the offset to achieve 0 at zero current. Typical values lie between -8 and +8. Note: This value is added not subtracted so if the zero reading is 6 then -6 will set the zero reading to 0.

Important: In most cases, accept where the duty cycle is 100%, the power supply current will not equal the motor current. At 10% duty cycle the motor current will be about 9 times the power supply current. With inductors or a stalled motor the current in the motor will build till the current limit trips, with little indication from the power supply.

Setting the STE bit 3(add 8) will allow scaling the Ilimit input pin. The scale is set with the serial port MIS command. The final current scaling is shown with the IMT output. The MIS is divided by 4. This allows the Ilimit pin to be scaled down without changing turns. This value is store nonvolatile.

Tricks: Moving the current sensor core away from the sensor center will increase the current trigger. Cutting a second gap in core will greatly increase current trip, depending on new gap size.

For brushed DC motors, as the brushes transition from one contact to another on the rotor there could be a high ripple current.

Current/Torque Control:

The current delivered to the motor con be controlled with the I limit value. The value is default selected with the filtered IL pin on the 14 pin connector or can be over ridden with an RS232 value. If the value is overridden with the RS232 value the IL line can be used to measure a external voltage.

The IL analog input line ranges from 0 to 5v. 5Volts being max current. This value is compared against the hall effect current sensor output – 2.5volts x 2. As indicated the hall effect current sensor is scaled to a 0 to 5v range before comparison. Negative hall effect currents will be converted to a positive value.

Increasing the loops through the current sensor will effect the current limiting. Increasing the loops will lower the current limiting value and provide more resolution at a lower current level.

Note: You may needed to remove R8(50k to 5v) or R9(50K to ground) for the correct open circuit voltage on the iL input pin.

IR compensation:

The motor controller allow for IR compensation. The IR compensation allows the duty cycle to increase automatically for a increase in load. The load is sensed from the current drawn, measured with the hall effect current sensor. As the current increases a value will be added to the duty cycle. The IR compensation compensates for resistive losses in the motor. The amount of compensation is limited to 25% of the duty cycle. A offset value is also, included for possible improved linearity. The commands IRM and IFS set the IR compensation. The volatile reading ICA (shown with ?) indicates how much is being added to the duty cycle with IR.

The calculation is kept simple to allow for various turns on the the hall effect current sensor.

The IRM command sets the multiplier and the IFS sets the offset. For testing purposes the IFS should be set to zero and latter added to trim.

This mode is always active, if both the IRM and IFS values are set to ZERO the IR compensation will have no effect. IFS is added to the current reading not subtracted, setting a negative value such as -8 is probable. If the ICA result is negative it will not be used and set to zero. The result is divided by 4 to allow for more resolution.

Notes:

Current sensor 22mv/Amp for single turn.

Analog to digital converter 4.88mv per bit

Therefore 22mv/4.88mv = 4.5 bits per Amp.

Offset for current sensor 2.5v

Note: The converter does not return decimals so 4.5 with end up 4 or 5.

Addition to Duty for 1 Amp and IRM set at 8:

ICA =(5 x 8 IRM)/4 = 10

If a offset(IFS) is applied, the addition to the duty will result in:

ICA = ((5-2)x8)/4=6

The power supply voltage can be read with the VS serial output.

Regeneration

The motor controller can achieve the regeneration function. During regeneration the motor acts as a battery in series with a large inductance, usually of many milli Henry. The motor's internal inductance is a key factor. The inductance is used to act as a inductor in a DC-DC converter. Current is built up in the inductor when shorted. When the short is opened the inductor will produce a very high voltage, higher than the supply voltage. The voltage is limited by the battery or over voltage setting.

In a large motor situation regeneration should be performed with care. Settling a proper deceleration is necessary. Find a low Ain(speed setting) to generate a smooth regenerative current the battery can handle. This method is synchronous allowing for the least losses and is adjustable. As the motor slows the Ain(speed setting) can be reduce to increase the regenerative current. The voltage on the brushed DC motor is proportional to the speed(RPM). As the motor slows the motor voltage will decrease requiring the short to remaining on proportionally longer on time than high side MOSFETs to generate the same current.

The over voltage trigger will help prevent damage during deceleration. The MOSFET's will open temporarily if the regeneration current builds up the voltage on the power supply line.

Motor Outputs:

1) M+ This output receives the pulsed width control of the same voltage as the +V of the supply when operating in the forward condition. When operating in the reverse the M+ line is tied to ground through the low side of the power MOSFET. This line also has high current diodes to both the +V supply and ground. The high current diodes will allow this driver to also act as a rectifier to charge a battery. Depending on the required current the wires to this line on the screw terminal should be made as large as possible. The motor and terminal screw terminal will except wire down to 12AWG.

2) M- This output receive the pulsed width control of the same voltage as the +V of the supply when operating in the reverse condition. When operating in the forward the M- line is tied to ground through the low side of the power MOSFET. This line also has high current diodes to both the +V supply and ground. The high current diodes will allow this driver to also act as a rectifier to charge a battery. Depending on the required current the wires to this line on the screw terminal should be made as large as possible.

Power Supply Inputs:

1) V+ Input powers the motor and control circuitry. Do not reverse the V+ and ground, reversing the power supply may damage the power MOSFETs or hopefully the blade fuse will blow. The power MOSFETs have an internal diode from the source to the drain. Consider using thick solid wire of at least 20AWG. Stranded wire should be used with care. The motor and terminal screw terminal will except wire down to 12AWG.

2) Gnd input is the unit ground. This input is also tied to the 10 pin control connector Ground inputs.

Wire Resistance Table

AWG	Diameter	Resistance per foot
24	20 mils (thousands of inches)	26 milliohms
22	25 mils	16 milliohms
20	32 mils	10 milliohms
18	40 mils	6.2 milliohms
16	50 mils	4 milliohms
14	64 mills	2.5 milliohms
12	80 mils	1.6 milliohms

Modes

Mode 0: This mode accepts the Duty cycle only from the Uart RS232 TTL connection.

Mode 1: Operates in the full 0-5v Ain range. The F/R line is active. Grounding the F/R line will reverse the motor. 0V is stop 5v is full speed. Grounding the TC line will activate coast mode, simulating a over temperature condition. In mode 0 there is a buffer range of .05v near 5v and 0v to allow for full speed and stop.

Mode 2: Operates in the full 0-5v Ain range. The F/R line is inactive. 0V is full reverse 5v is full forward and 2.5v is stop. Grounding the TC line will activate coast mode, simulating a over temperature condition. There is a buffer range of .05volts near 5v, 0v, 2.5v to allow for full speed and stop.

Mode 3: Operates in the 1-4v Ain range. Many hall effect throttles on the market have an output range of 1v to 4v. The F/R line is active. Grounding the F/R line will reverse the motor. Below 1V is stop above 4v is full speed. Grounding the TC line will activate coast mode, simulating a over temperature condition.

Mode 4: Operates in the 1-4v Ain range. The F/R line is inactive. Below 1V is full reverse 4v is full forward and 2.5v is stop. Grounding the TC line will activate coast mode, simulating a over temperature condition. There is a buffer +/.25 near 2.5v to allow for full stop.

Mode 5: Same as mode 1 except the buffer at 0v and 5v is .25volts

Mode 6: Same as mode2 except the buffer at 0v 2.5v and 5v is .25volts

Mode 7: This mode excepts PCM(pulse code modulation) digital signals on the Ain line. PCM is typically used for RC receivers. F/R line is inactive.

A 1000us pulse is full reverse. A 2000us pulse is full forward. A 1500us pulse is stop. There is about a 300us buffer zone at the low and high ends to allow for full speed forward and reverse. Above and below the 300us buffer range the controller will not respond.

If no signal is present on the Ain line for more than ~3 seconds the controller will stop. If a invalid pulse width input occurs, the unit will not respond and require ~3 good pulses to restart.

Dimensions

Height: 1.75 inches (depend on power capacitor)

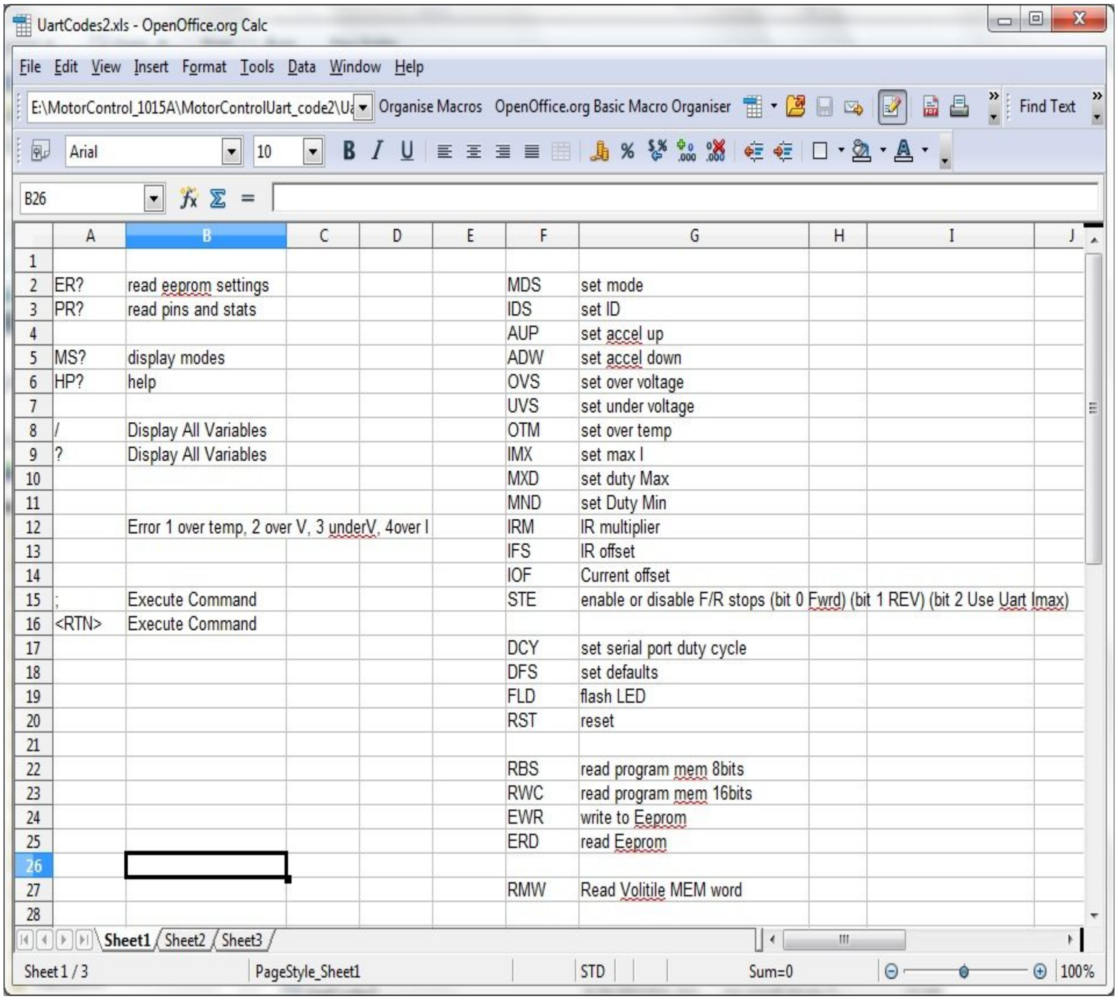
Length: 3.5 inches

Width: 2.5 inches

Serial Port RS232 TTL Codes

This unit features a serial port for control and parameter settings. Once the parameters are set the serial is not required for normal operation. The serial port is needed to set up the acceleration, over temperature, over/under voltage, maximum duty, optional IR multiplier, and optional ID.

The motor controller can be completely controlled with the serial port. The output current can be measured as well as the power supply voltage, analog input pins, status and temperature.



	A	B	C	D	E	F	G	H	I	J
1										
2	ER?	read eeprom settings				MDS	set mode			
3	PR?	read pins and stats				IDS	set ID			
4						AUP	set accel up			
5	MS?	display modes				ADW	set accel down			
6	HP?	help				OVS	set over voltage			
7						UVS	set under voltage			
8	/	Display All Variables				OTM	set over temp			
9	?	Display All Variables				IMX	set max I			
10						MXD	set duty Max			
11						MND	set Duty Min			
12		Error 1 over temp, 2 over V, 3 underV, 4over I				IRM	IR multiplier			
13						IFS	IR offset			
14						IOF	Current offset			
15	;	Execute Command				STE	enable or disable F/R stops (bit 0 Fwrd) (bit 1 REV) (bit 2 Use Uart Imax)			
16	<RTN>	Execute Command								
17						DCY	set serial port duty cycle			
18						DFS	set defaults			
19						FLD	flash LED			
20						RST	reset			
21										
22						RBS	read program mem 8bits			
23						RWC	read program mem 16bits			
24						EWR	write to Eeprom			
25						ERD	read Eeprom			
26										
27						RMW	Read Volitile MEM word			
28										

A USB to TTL converter plugs directly into a USB port. The motor control unit must be powered up for communication to begin. Three wires RX,TX, and Gnd are attached to the motor controller. A program such as Hyterterminal is used to communicate with the unit. There are several programs available online for serial port communication such as hyperterminal which is on all XP computers, and putty which is free online. Most programming languages can access the serial ports.

The communication settings are 9600 Baud rate, 8 bits, None for hardware feedback. Computers could have several configured COM ports, the correct COM port must be selected.

The motor controller unit can access 9 motor controllers on the same serial line. The RX,TX and ground lines are all tied together, the ground may not to be chained if a common power supply ground is configured. The ID is set with the IDS command. Note only 1 unit can be can the line when setting the ID'S.

Also note the personal computer TX(transmit) connects to the RX(receive) of the motor controller.

All parameters and queries are 16bit intergers.

The command is executed after a return or semicolon is received.

Example:

AUP 100;

This will set the acceleration to 100. One being the slowest and 30000 being the fastest.

Example:

?;

?<RTN>

/;

/ <RTN>

Will all display the volatile and nonvolatile parameters and measurements.

The identification for a motor controller can also be assigned. The SID command is used to set the ID. Once the ID is set the computer can direct a command to a specific motor controller.

Example:

1AUP 100;

This will send the command to the unit with ID of 1. If the first digit is 0 or not included all controllers on the line will respond. If more than one controller are on the line and a global transmit is issued no damage will occur.

Example:

0ADW 200;

Set all controllers on RX line to have a deceleration of 200.

Example:

8ADW 300;

set controller on line with ID 8 to have a deceleration of 300.

STE

The STE command will enable or disable the Forward and reverse stop and allow the serial port to over ride the duty cycle.

Bit 0 : Forward stop enabled if high

Bit 1: Reverse stop enabled if high

Bit 2: Over ride Duty cycle from Ain with serial port value.

Bit 3: Use scaled input current limit reading(allows voltage on iL pin to be scaled, typically used to limit current range)

Example:

STE 3

; enables forward and reverse stop

STE 1

;enable just forward stop

STE 7

; enable all stops and over ride Ain

8STE 4

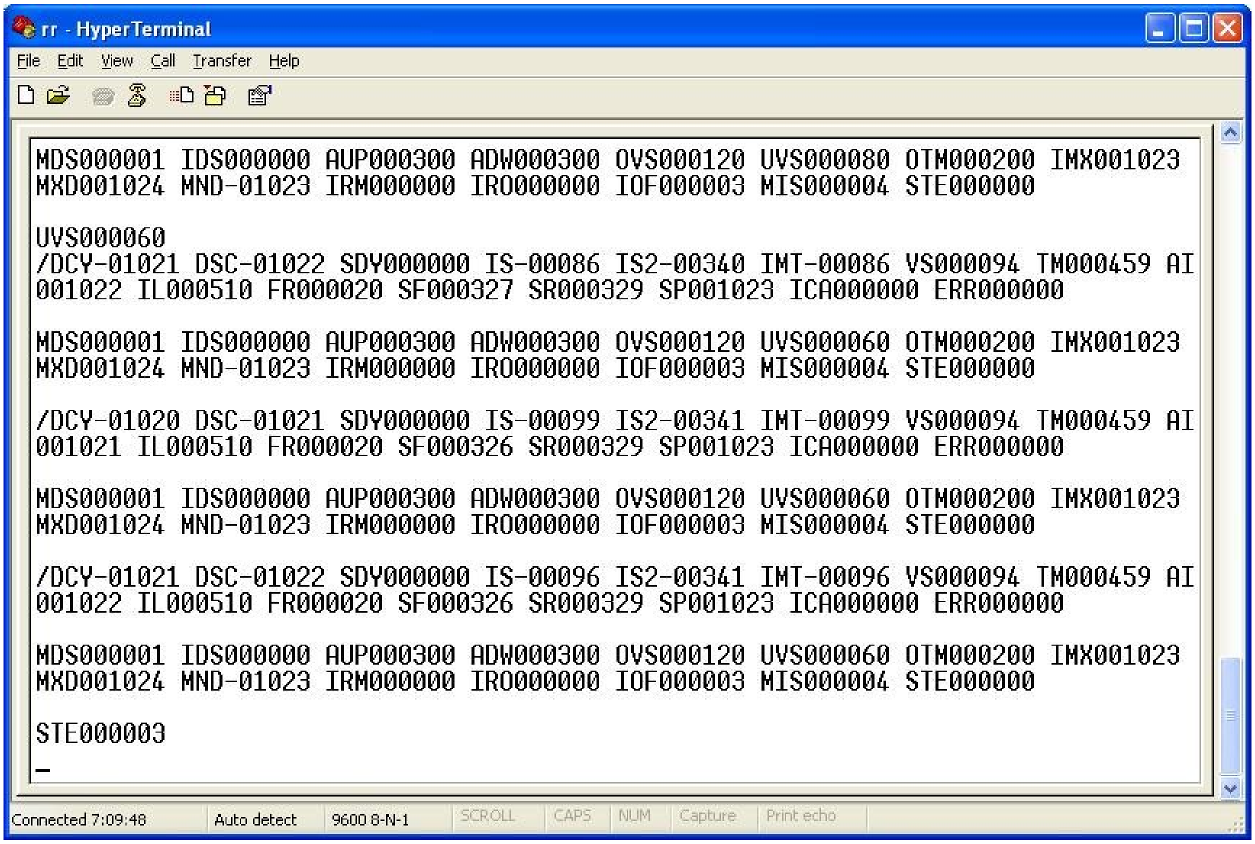
; disable stops and enable over ride of AIN on just unit with ID 8

MDS

The MDS will set the mode.

Example:

MDS 0


rr - HyperTerminal
File Edit View Call Transfer Help
MDS000001 IDS000000 AUP000300 ADW000300 OVS000120 UVS000080 OTM000200 IMX001023
MXD001024 MND-01023 IRM000000 IRO000000 IOF000003 MIS000004 STE000000
UVS000060
/DCY-01021 DSC-01022 SDY000000 IS-00086 IS2-00340 IMT-00086 VS000094 TM000459 AI
001022 IL000510 FR000020 SF000327 SR000329 SP001023 ICA000000 ERR000000
MDS000001 IDS000000 AUP000300 ADW000300 OVS000120 UVS000060 OTM000200 IMX001023
MXD001024 MND-01023 IRM000000 IRO000000 IOF000003 MIS000004 STE000000
/DCY-01020 DSC-01021 SDY000000 IS-00099 IS2-00341 IMT-00099 VS000094 TM000459 AI
001021 IL000510 FR000020 SF000326 SR000329 SP001023 ICA000000 ERR000000
MDS000001 IDS000000 AUP000300 ADW000300 OVS000120 UVS000060 OTM000200 IMX001023
MXD001024 MND-01023 IRM000000 IRO000000 IOF000003 MIS000004 STE000000
/DCY-01021 DSC-01022 SDY000000 IS-00096 IS2-00341 IMT-00096 VS000094 TM000459 AI
001022 IL000510 FR000020 SF000326 SR000329 SP001023 ICA000000 ERR000000
MDS000001 IDS000000 AUP000300 ADW000300 OVS000120 UVS000060 OTM000200 IMX001023
MXD001024 MND-01023 IRM000000 IRO000000 IOF000003 MIS000004 STE000000
STE000003
Connected 7:09:48
Auto detect
9600 8-N-1
SCROLL
CAPS
NUM
Capture
Print echo

Serial Port Troubleshooting

- **1**: Down load the correct driver for the USB to serial cable for your operation system and computer from the WEB. The USB to Serial TTL we are current shipping is for a Prolific PL2303. Other USB to serial TTL are also sold though distributors. The Current link is www.prolificusa.com/pl-2303hx-drivers

- On the prolific cable the blue wire is RX, red TX, and orange is ground

- Select the correct COM port, baud rate, data bits, parity, stop bits, and flow control.

- Without connection the cable to the motor controller, the RX and TX lines can be connected together to test if the cable is functioning properly. With the TX and RX shorted the character typed should echo to the terminal emulator.

- Verify the USB-Serial-TTL cable show up the the operating system device manager. Reboot computer if you are experiencing problems.

- With high voltage and high current signals emanating from the motor controller noise pickup could be a issue. A capacitor or filter maybe need on the RX and TX lines to eliminate spikes for continuous RS232 setups. Reboot if necessary.

- The motor controller must be powered up for communication. Use of a lower voltage power supply can be used for setup.

Diagrams

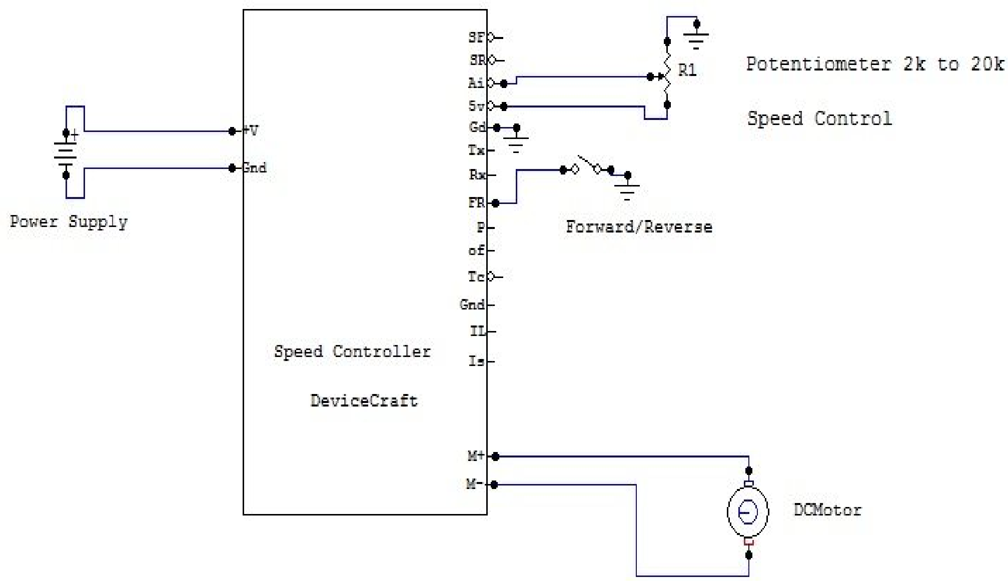


Illustration 2: Simple Hookup Diagram

Note: The forward / reverse switch is not needed for testing and single knob control

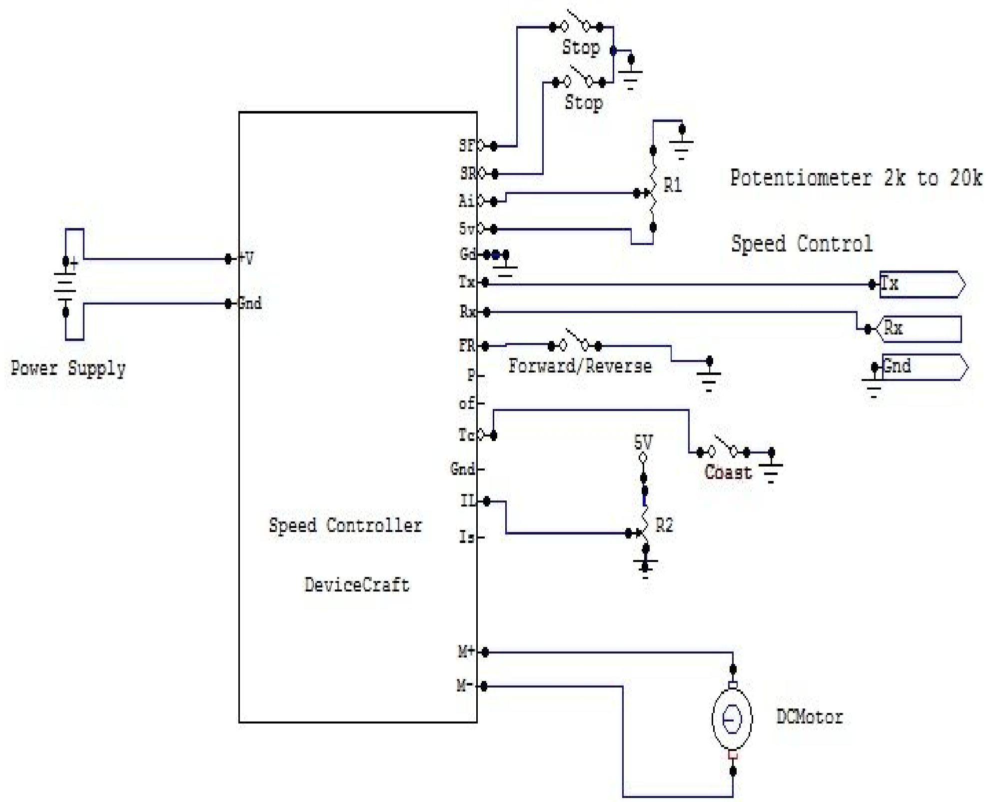


Illustration 3: Hookup with current limit, coast, Serial port, and stops

Note: STE must be set correctly for stops to be active. If the current limit is set internally then the IL line can be used as a coast which provides additional filtering.

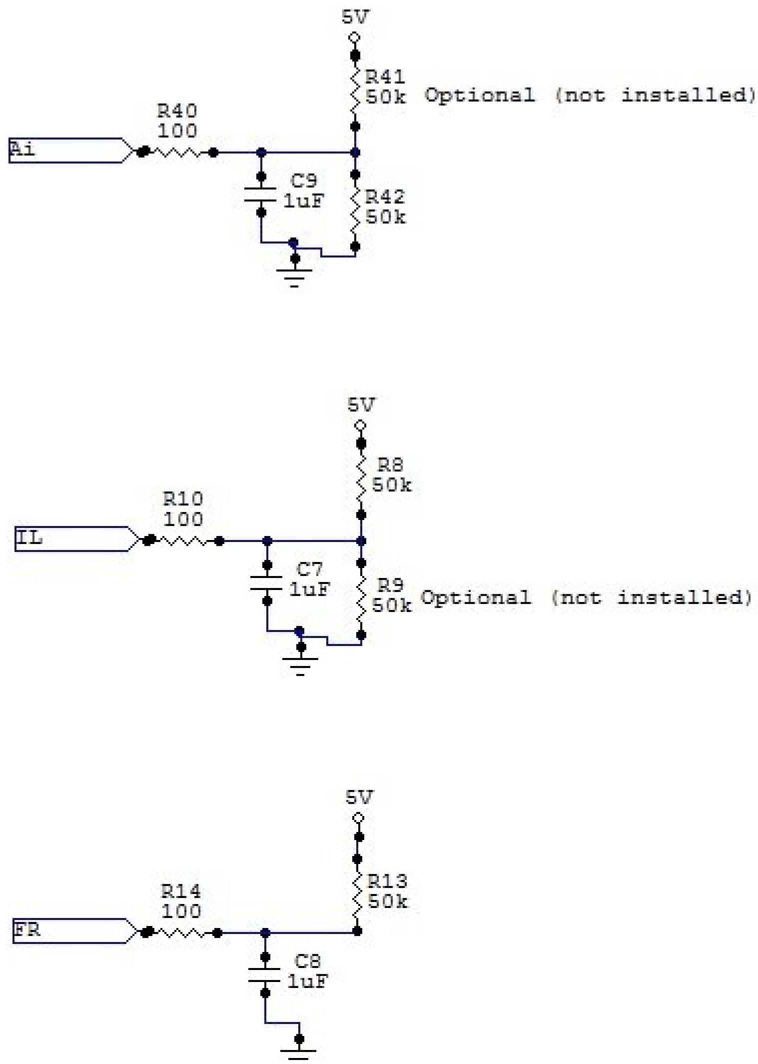


Illustration 4: Input Filters

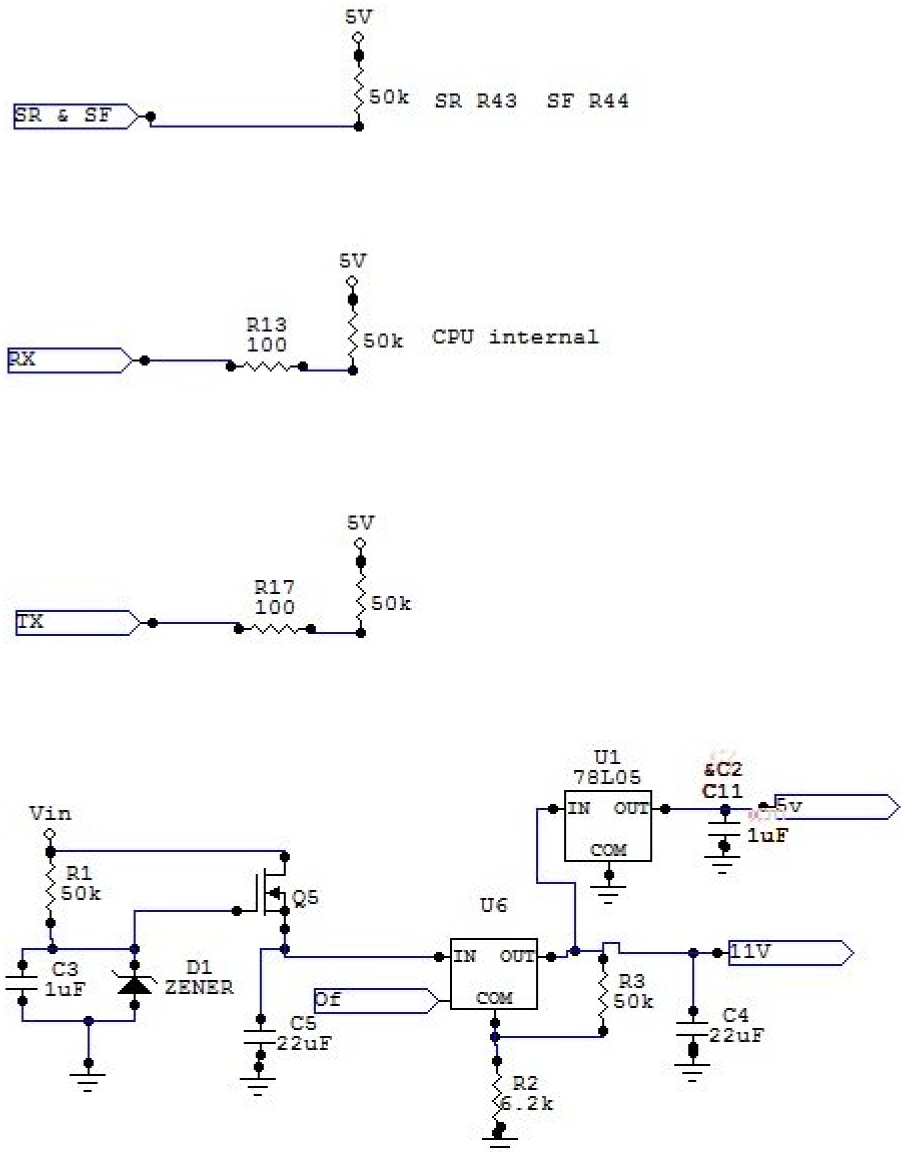


Illustration 5: Stops, TX, RX, and regulator

Note: for operation below 14volts remove R1(optional) jumper/diode across drain and source of Q5