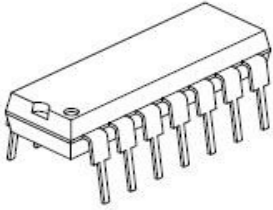


# DeviceCraft



## 1005 Series Replacement/Modification IC

<p>(P/N 1005-Standard) Note: Prior Pot version</p>	<p>Forward and Reverse speed control with single potentiometer</p> <ul style="list-style-type: none"><li>• Single Potentiometer control of speed and direction</li><li>• Ramp/Acceleration control</li><li>• Coast and Brake lines</li></ul> <p>See Standard data sheet for specifications</p>
<p>(P/N 1005-Alt) Note: Prior standard version</p>	<p>Alternate product reversible speed controller</p> <ul style="list-style-type: none"><li>• Special forward/Reverse line</li><li>• Reverse stop</li><li>• Forward stop</li><li>• Regenerative stopping (will continue regeneration till flywheel stops)</li></ul>
<p>(P/N 1005-Direct)</p>	<p>Directly control H-Bridge MOSFETS</p> <ul style="list-style-type: none"><li>• Direct MOSFET Control allows for custom CPU control of H-Bridge</li><li>• 3 digital line control (Disable, M+ side, M- side)</li><li>• Hall effect over current protection</li><li>• Thermistor over temperature protection</li><li>• Shoot through prevention</li></ul>
<p>(P/N 1005-Wave)</p>	<p>Bi Polar wave generation transformer drive</p>

	<ul style="list-style-type: none"> <li>• Automatic Waveform creation using internal look up tables</li> <li>• 4 waveforms Sine, Square, Modified Sine, and Triangle</li> <li>• Variable frequency from 20Hz to 420Hz</li> <li>• Hall effect over current protection</li> <li>• Thermistor over temperature protection</li> <li>• Shoot through prevention</li> </ul>
(P/N 1005-Coil)	<p>No ramp time for single Bi Polar coil driving</p> <ul style="list-style-type: none"> <li>• No ramp time for actuating coils</li> <li>• Variable duty cycle or speed control</li> <li>• Hall effect over current protection</li> <li>• Thermistor over temperature protection</li> </ul>
(P/N 1005-PCM)	<p>Accepts PCM signals from RC receiver</p> <ul style="list-style-type: none"> <li>• Accepts industry standard 1ms to 2ms pulse signals</li> <li>• No signal indicator</li> <li>• Forward and reverse stop pins</li> <li>• Noise rejection routine on digital lines</li> <li>• Shuts down motor with no signal</li> </ul>
<p>(P/N 1005-Torque)</p> <p>Note: requires additional time constant capacitor on current sense line. Various current ranges to optimize, please contact sales for requirements</p>	<p>Controls Maximum current(torque) and Maximum duty cycle</p> <ul style="list-style-type: none"> <li>• Analog torque and speed control</li> <li>• Optional stop, coast, brake functions</li> </ul>

## Input/Output Pins P/N 1005-Standard:

Pin	Name	Function
2	Ain label	Analog Input 0 volt to 2.5 volts Reverse (0v full reverse) 2.5 volt to 5.0volts Forward (5v full forward) 50k resistor to ground at input
6	Rs label	Digital Input Brake Pull to 0v to enable braking 20k resistor to 5v at input on board.
7	Fs Label	Acceleration(Ramp rate) 0v for maximum acceration 5v(5sec) for slow acceleration
8	F/R Label	Digital Input Coast Pull to 0v to enable coasting(all MOSFETS off) 20k resistor to 5v at input on board

## 1005-Standard Description

The 1005-Standard allows the operation of forward and reverse with a single line. Zero reversing delay for ultra fast direction change. Time delay from full speed forward to full speed reverse depends on power supply voltage, motor, motor load, and set acceleration time. With this configuration the motor can be driven to change direction or slowed. Power supply currents can be high during a quick driven direction change.

The coast line shuts off the MOSFETS opening the motor terminals allowing for a powerless slowing. If the motor is generating more voltage then the power supply the current will be delivered back to the supply source.

The brake line shorts the motor leads allowing for quick stopping and resistance to no power motor movement. This line should be used with care with large motors. Driving the motor to stop with the Ain line is recommended. The over current protection is not active during braking, current is circulated in low side MOSFETs.

The acceleration is controlled with the Fs(Accel) line. A slow acceleration prevents damage to motor and gears. A slow acceleration will reduce stall currents and prevent the over current protection circuitry from triggering.

## Modified Input/Output Pins P/N 1005-Alt:

Note: Prior standard

Pin	Name	Function
2	Ain label	Analog Input .8 volt to 4 volts (below .8v stop) (above 4v full speed) hall effect throttle compatible input. 50k resistor to ground at input
6	Rs label	Digital input Pull to 0v to stop reverse motion 20k resistor to 5v at input on board.
7	Fs Label	Digital Input Pull to 0v for to stop forward motion 20k resistor to 5v at input on board.
8	F/R Label	Forward/Reverse selection line 5volt forward 0volt reverse 20k resistor to 5v at input on board

## 1005-Alt Description

The 1005-Alt was the original configuration. This configuration is best for applications where reversing quickly is not desirable, regenerative stopping/reversing is needed, or wasted current driving a direction change is not desirable. Regenerative stopping makes use of the motor inductance to act as a DC-DC converter and generate a voltage higher than the supply voltage.

The F/R line controls motor direction. When switching then F/R line, the regeneration routine will execute before reversing the motor. The length of time depends on motor speed with a minimum time of ~50milliseconds. The regeneration routine will stop when no regenerated current is detected.

Forward and reverse stop lines are useful for many applications. A switch can be triggered to prevent over travel allowing motor movement only in the opposite direction. These lines can be used for a computer less back and forth motion.

## Modified Specifications P/N 1005-Direct

Over Current Response Time	~10us
Startup Time	~1Sec
Digital input propagation delay time	5usec
Duty Cycle	0 to ~100%
Maximum PWM switching rate	~30 Khz

## Modified Input/Output Pins P/N 1005-Direct:

Pin	Name	Function
2	Ain label	Digital Input Bootstrap Recharge Enable when low or open 50k at input to ground for protection. Low allow bootstrap recharge every 1/30 second High stop bootstrap recharge
6	Rs label	Digital Input Disable all Bridge MOSFETS when low 20k resistor to 5v at input on board.
7	Fs Label	Digital Input Enable M- side <b>High</b> Side MOSFET when high Enable M- side <b>Low</b> Side MOSFET when low 20k resistor to 5v at input on board
8	F/R Label	Digital Input Enable M+ side <b>High</b> Side MOSFET when high Enable M+ side <b>Low</b> Side MOSFET when low 20k resistor to 5v at input on board

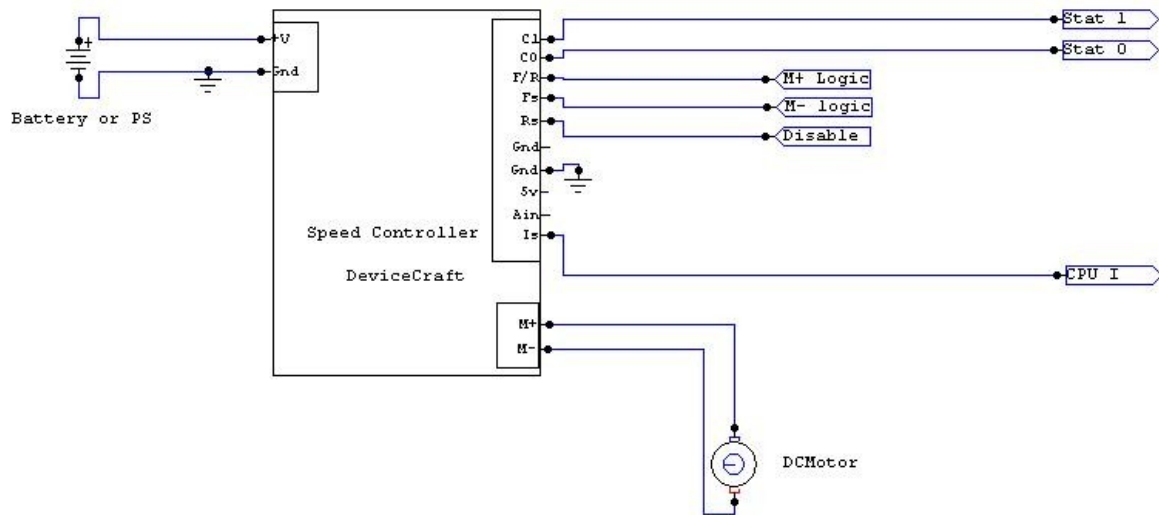


Figure 2: Simple Direct hookup diagram

Notes:

- 1) Connect Ain (pin2) to 5v to disable bootstrap recharge.

## 1005-Direct Description

The 1005-Direct-Drive is a modification or replacement dip for the 1005 series H-Bridge controllers. The 1005-Direct-Drive allows the direct control over the activation of the 4 MOSFETS in the bridge.

The circuit continues to provide high side short circuit protection and thermal over temperature protection.

The user is responsible to ensure during braking or reversing the current ratings of the MOSFETs are not violated. For example if the high voltage controller is spinning a motor at 120Vdc and the motor has 1/3 ohm of resistance the braking/reversing current could approach 360Amps. The hall effect sensor will not presently sense reverse current. The case is true even if the motor has low load and drawing little current. A power resistor can be placed in series with the motor to limit the braking current. The user could also sense the voltage across the motor leads to ensure the motor has slowed before braking or reversing. Usually MOSFETs can handle many times their rated current for short periods of time. The IRF640 high voltage MOSFET is rated for 18Amps and can handle 70Amps for short periods. The IRFZ44 MOSFET is rated for 50Amps and handle 150Amps for short periods.

Note: The speed controller firmware version senses reverse current before attempting reversing. The approach is not practical for the direct drive version.

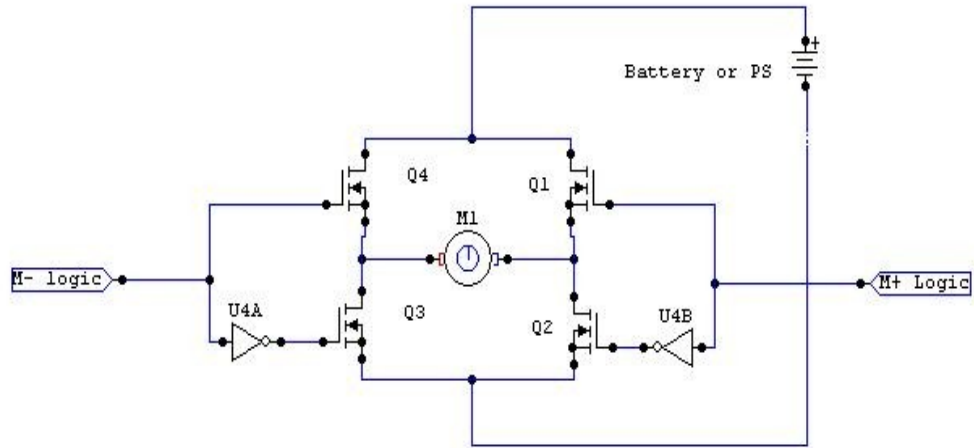


Figure 3: Simplified Direct Drive Schematic

## Modified Input/Output Pins P/N 1005-Wave:

Pin	Name	Function
2	Ain label	Analog Input Adjust output frequency 0v(low frequency) 5v(maximum frequency) 50k at input to ground for protection.
6	Rs label	Digital Input Select type of output waveform along with Fs 20k resistor to 5v at input on board.
7	Fs Label	Digital Input In the future this will control the amplitude 5v or open to enable output Ground to disable output 20k resistor to 5v at input on board
8	F/R Label	Digital Input Selects type of output waveform along with Rv 20k resistor to 5v at input on board

## Wave Truth Table

Wave Type	Rs	Fw/Rv	Fs
Sine	5V(open)	5V(open)	5V(open)
Square	5V(open)	0V	5V(open)
Modified Sine	0V	5V(open)	5V(open)
Triangle	0V	0V	5V(open)
Disable	X	X	0V(Gnd)

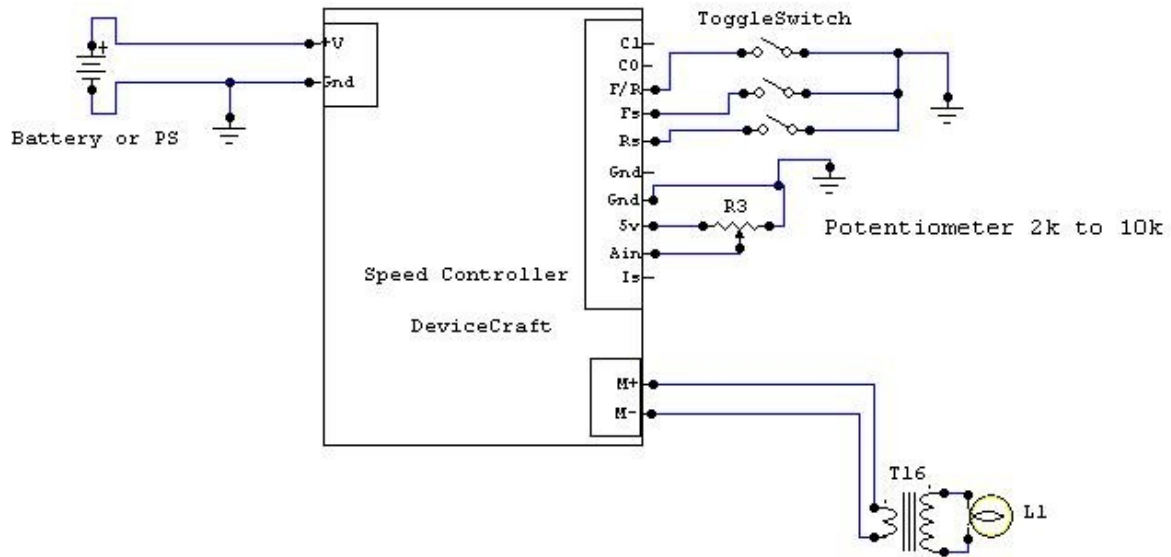


Figure 4: Simple Wave hookup diagram

## 1005-Wave Description

The 1005-Wave is a modification or replacement dip for the 1005 series H-Bridge controllers. The 1005-Wave allows PWM output of 4 waveforms. The 4 waveforms consist of Sine, Square, modified sine, and triangle wave. The frequency can be varied from ~20hz to 400hz by adjusting the potentiometer. The potentiometer can be replaced with a resistor divider once a constant frequency has been selected.

The applications for this circuit range from DC-DC converters to sound generation. The output voltage is proportional to the battery or supply voltage. Output voltage variation can be achieved for slightly custom modifications with a reduction in capability. The large low resistance MOSFETS allow for an efficient means for generation of low frequency bipolar signals.

## Modified Specifications P/N 1005-Coil

Startup Time	~1Sec
Digital input propagation delay time	150usec
Duty Cycle	0 to ~97%
PWM frequency	17Khz

## Modified Input/Output Pins P/N 1005-Coil:

Pin	Name	Function
2	Ain	PWM duty cycle analog input 50k at input to ground for protection. Below ~1v input indicates no power(same as 0v) Above ~4v input indicates full power(same as 4v) Between 1v and 4v input varies the duty cycle
6	Rs	Digital Input, Reverse Stop when pulled low 20k resistor to 5v at input on board. Pull this input to ground to stop the motor going reverse.
7	Fs	Digital Input, Forward Stop when pulled low 20k resistor to 5v at input on board Pull this input to ground to stop the motor going forward.
8	F/R	Digital Input, Forward when High Reverse when pulled low

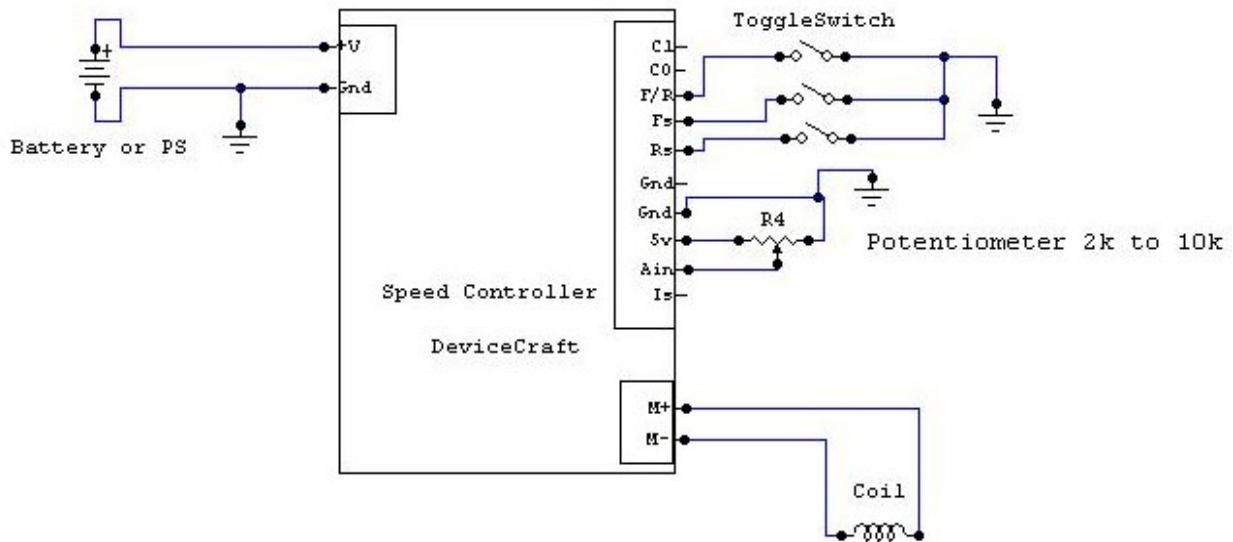


Figure 5: Simple Coil hookup diagram

## 1005-Coil Description

The 1005-Coil is a modification or replacement dip for the 1005 series H-Bridge controllers. The 1005-Coil is a slight modification of the standard motor speed controller. The 1005-Coil firmware is optimized for driving coils. The ramp time routine has been removed to provide for fast coil driving. The PWM and analog duty cycle control are still operational as well as the forward and reverse stop lines. The ramp time has been reduced to 150usec. The over current and over temperature detection are still operational.

## Modified Input/Output Pins P/N 1005-Pot:

Pin	Name	Function
2	Ain	PWM duty cycle analog input 50k at input to ground for protection.~2.5volts stop Below ~2.5v input reverse Above ~2.5v input forward 0v full speed reverse 5v full speed forward
6	Rs	Digital Input, Brake when pulled low 20k resistor to 5v at input on board. Pull this input to ground to brake the motor
7	Fs	Analog Input Ramp Time 5v for ~5.0 Second ramp to full speed 2.5v for 2.5 seconds to full speed 0v for ~100msec to full speed 20k resistor to 5v at input on board
8	F/R	Digital Input, Coast when pulled low 20k resistor to 5v at input on board.

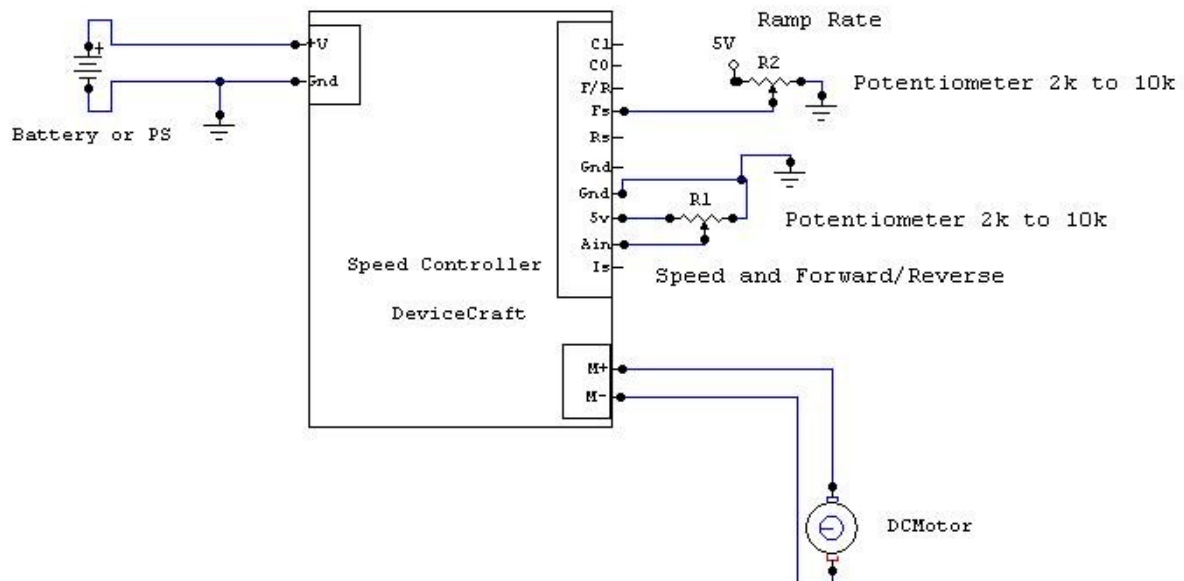


Figure 6: Simple Pot hookup diagram

## 1005-Pot Description

The 1005-Pot is a modification or replacement dip for the 1005 series H-Bridge controllers. The 1005-Pot modification allows the speed and direction to be controlled with a single potentiometer. The reverse speed is controlled with a voltage range of 0v to 2.5v, the forward range is controlled with the 2.5v to 5v range. Full speed reverse is 0v, full speed forward is 5v. Stop is achieved with 2.5 volts on the Fs line or one of the stop lines can be pulled down to ground.

An additional Potentiometer/Resistor attached to the Fs input will now control the ramp speed. The ramp speed is controllable from 100msec to 5sec. The default ramp speed is set to 5sec via the 5v on board pullup resistor. A slow ramp speed will reduce strain on the motor, gears, and power supply.

## Modified Input/Output Pins P/N 1005-PCM:

Pin	Name	Function
2	Ain	PCM(Pulse code modulation) digital input (<.8volt low, >2volt high) 50k at input to ground for protection. 1msec full speed reverse 1.5msec stop 2msec full speed forward  >2.5msec stop <.8msec stop No signal for .2sec stop
6	Rs	Digital Input, Reverse Stop when pulled low 20k resistor to 5v at input on board. Pull this input to ground to stop the motor going reverse.
7	Fs	Digital Input, Foward Stop when pulled low 20k resistor to 5v at input on board. Pull this input to ground to stop the motor going forward.
8	F/R	No input 20k resistor to 5v at input on board.