



**Haydon Switch & Instrument, Inc.**

***P/N DCS4020***  
***Bipolar***  
***Chopper Drive Manual***

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# Bipolar Chopper Drive Manual

## Model DCS4020

### Introduction

The bipolar chopper drive has been designed for easy set-up and use. It is ideal for development projects, just connect a single power supply and a motor and the drive is ready to run. Motor current is set using an on-board potentiometer. No external current setting resistors are required. This feature-packed drive provides all basic motor controls, including full or half stepping of bipolar steppers and direction control. An oscillator circuit is standard on the drive with an on-board speed control potentiometer. In addition, external input/output signals allow complete remote control of all drive functions.

### Specifications

<b>Nominal Dimensions</b>	113.3 mm L X 78.0 mm W X 33.1 mm H (including mating connectors)
<b>Input Voltage</b>	+24 to +40 Vdc
<b>Motor Direction</b>	Selected via on-board switch or external control via input/output (I/O) connector.
<b>Motor Enable</b>	Enabled/disabled via on-board switch or external control via I/O connector.
<b>Step Rate</b>	<i>Single step operation:</i> via on-board push-button switch or external pushbutton switch via I/O connector.  <i>Continuous operation:</i> via on board potentiometer controlled oscillator (10 Hz to 2 KHz).  <i>External Control:</i> via I/O connector.
<b>Motor Current</b>	Adjustable from ~66 mA/Ø to ~3 A/Ø. 2 A/Ø continuous duty rating. (Up to 3A/Ø peak non-repetitive rating.)
<b>Stepping Modes</b>	Full step - 2 phases ON Half stepping
<b>Bipolar Drive</b>	Dual full bridge motor driver based on ST Microelectronics part numbers L297 and L298N.
<b>Power Supply</b>	24 Vdc minimum 40 Vdc maximum (reduce power supply voltage if drive heatsink temperature exceeds 55°C). Current up to 4 Amps depending on stepper motor used.

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## Power Supply Connections

1. Connect the “positive” (+) lead to + Vdc.
2. Connect the “negative” (-) lead to GND.

This supply powers the stepper motor and electronics (via an on board 5 v regulator).

This drive is intended to operate a low power bipolar stepping motor.

The 4 lead wires from the motor are connected to the removable 4 pin connector, (see “Connector Pin Allocation” for the proper wiring sequence).

**WARNING:** To prevent damage to motor driver turn off power supply or disable motor outputs **BEFORE** connecting or disconnecting motor leads.

## Setting Motor Current

Ensure that the motor leads are connected to the drive and that power is applied at + Vdc and GND. Flip the Enable switch to the ON position. Connect a high impedance (DVM) type voltmeter to the VREF + and VREF - terminals. Adjust the Current Adj. potentiometer, while monitoring the voltmeter, to set the motor current per the following formula:

$$\text{RMS Motor current (Amps)} = 2 \times \text{V Ref (Volts)}.$$

Example: To set a motor current of 0.75 A/Ø, adjust P2 until V Ref reads 0.375 Volts.

Remove the voltmeter.

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## Switch Settings - Local Control

### Step Rate

	SW1-1	SW1-2
Single Step	ON	ON
Continuous Step	ON	OFF

### Motor Enable

	Enable
Enable	OFF
Disable	ON

### Motor Direction

	Direction
Clockwise	ON
Counter Clockwise	OFF

### Step Mode

	Half/Full
Full Step (2 phases on)	ON
Half Step	OFF

### Step Clock Select

	Clock Select
Internal Oscillator	ON
External	OFF

Step Rate Adjustment: The step rate can be varied between 10 steps/sec and 2000 steps/sec by adjusting the Speed Adj. potentiometer.

## External I/O Control

External Clock: An external clock or pulse source can be substituted for the on-board oscillator. This can allow indexing and ramping of the motor.

1. Flip the Clock Select switch to the OFF position.
2. Connect an external oscillator to X Clock (T2A-3) and GND.
3. Signal amplitude must remain within the limits of 0 to +5V (TTL Logic).

External Direction Control:

1. Flip the Direction switch to the OFF position.
2. Connect external direction control to X Direction (T2A-4) and GND. Logic low for CW, Logic high for CCW.
3. Signal amplitude must remain within the limits of 0 to +5V (TTL Logic).

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## External I/O Control con't

### External Enable Control:

1. Flip the Enable switch to the OFF position.
2. Connect external enable control to X Enable (T2B-5) and GND. Logic low for disabled, Logic high for enabled.
3. Signal amplitude must remain within the limits of 0 to +5V (TTL Logic).

### External Step Rate Control: Provisions have been made to control the on-board oscillator with an external fixed or variable resistor.

1. Clip open jumper J3 to disable the on-board potentiometer P1.
2. Connect a fixed or variable resistor between terminals X Pot. + and X Pot. -.  
If using a variable resistor then connect 270 ohm or larger resistor in series with the variable resistor.
3. The step rate can be changed by varying the value of the external resistance.

### External Half/Full Step Control:

1. Flip the Half/Full step switch to the OFF position.
2. Connect external control to X Half/Full (control can even be a switch to GND. Logic low for full step, logic high for half step.
3. Signal amplitude must remain within the limits of 0 to +5V (TTL logic).

### External Single Step Switch Control:

1. Flip the on-board Switches (SW1-1 ) to OFF, and (SW1-2) to the ON position.
2. Connect a normally-open momentary switch between terminals X Sgl. Step and GND.  
Note: The on-board single step pushbutton switch will remain active in this mode.
3. The external switch can remain connected even when switching back to the continuous step mode.

### External Reset Control:

1. Connect external reset control to X Reset and GND. Logic low for reset (translator at "home" state, i.e. L297 I.C. outputs A, Not A, B, Not B = 0101), Logic high (or floating) for normal operation.
2. Signal amplitude must remain within the limits of 0 to +5V (TTL logic).

### "Home" State Output:

1. This is an open collector output that indicates when the L297 I.C. is in the "home" state (outputs A, Not A, B, Not B = 0101).
2. Connect a "pull-up" resistor (value of 1K ohm through 5K ohm) between this output (Home) and +5V (X Pot. +). Logic low output is inactive state, logic high output is active "home" position state.

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## Connector Pin Allocation

PIN #T1	PIN #T2	Description - Can Stack Motors	Hybrid Motors
1		Bipolar drive output, RED (Phase A)	RED
2		Bipolar drive output, BLACK (Phase Not A)	RED/WHITE
3		Bipolar drive output, BLUE (Phase B)	GREEN/WHITE
4		Bipolar drive output , GREEN (Phase Not B)	GREEN
	A1	Common negative (-) connection (GND)	
	A2	External power input, positive (+) 24 to 40 Vdc (+Vdc)	
	A3	External clock input (X Clock)	
	A4	Internal chopper sync output (Sync)	
	A5	"Home" state output (Home)	
	A6	+5V output - also optional external potentiometer connection (X Pot. +)	
	B1	Optional external potentiometer connection ( X Pot. -)	
	B2	External half step/full step control (X Half/Full)	
	B3	External reset control (X Reset)	
	B4	External direction control (X Direction)	
	B5	External enable control (X Enable)	
	B6	Optional external single step switch connection (X Sgl. Step)	

