MODEL 13DVA Rev.A / 15DVA Rev.A HOOK-UP

WARNING

IMPROPER INSTALLATION OR OPERATION OF THIS CONTROL MAY RESULT IN INJURY TO PERSONNEL OR ELECTRONIC FAILURE. THE CONTROL MUST BE INSTALLED AND GROUNDED IN ACCORDANCE WITH LOCAL, STATE, AND NATIONAL SAFETY CODES. AT NO TIME SHOULD THE CIRCUIT CONTINUITY BE CHECKED BY SHORTING TERMINALS WITH A SCREWDRIVER OR OTHER METAL DEVICE.

PLEASE READ COMPLETELY BEFORE MAKING ANY ADJUSTMENTS

HOOK-UP & TERMINAL IDENTIFICATION

1) Before attempting to wire the control, make sure all power is turned off.

2) Use a normal blow fuse, wired in series with hot side of AC input, rated to 125% of motor current. Note: Both AC lines should be fused for 240 VAC input.

CAUTION SHOULD BE USED IN SELECTING THE SIZE OF HOOK-UP WIRING. LIMIT THE VOLTAGE DROP THROUGH THE WIRING TO 5% OF THE LINE VOLTAGE AT FULL LOAD.

3) +ARM: Connect to plus (+) Armature wire on motor. 0-90 VDC for 120 VAC input, and 0-180 VDC for 240 VAC input.

4) -ARM: Connect to minus (-) Armature wire on motor.

5) -FIELD: Connect to minus (-) Field wire of Shunt Wound Motor.

6) AC1 and AC2: 120 VAC - Connect incoming hot AC (black wire) to AC1 and neutral (white wire) to AC2
240 VAC - Connect both hot sides, one to AC1 and one to AC2.

7) +FIELD: Do not use for permanent magnet motor. This supplies +Field voltage for a Shunt Wound Motor. For motors with dual voltage field (ie; 50/100V or 100/200V), make sure the highest value is connected.

CAUTION: DO NOT ATTEMPT TO PERFORM A HI-POT TEST ACROSS AC LINES WITH CONTROL IN CIRCUIT. THIS WILL RESULT IN IMMEDIATE OR LONG TERM DAMAGE TO THE CONTROL.

ADJUSTMENTS

1) Preset trimpots in the counter-clockwise (CCW) position.

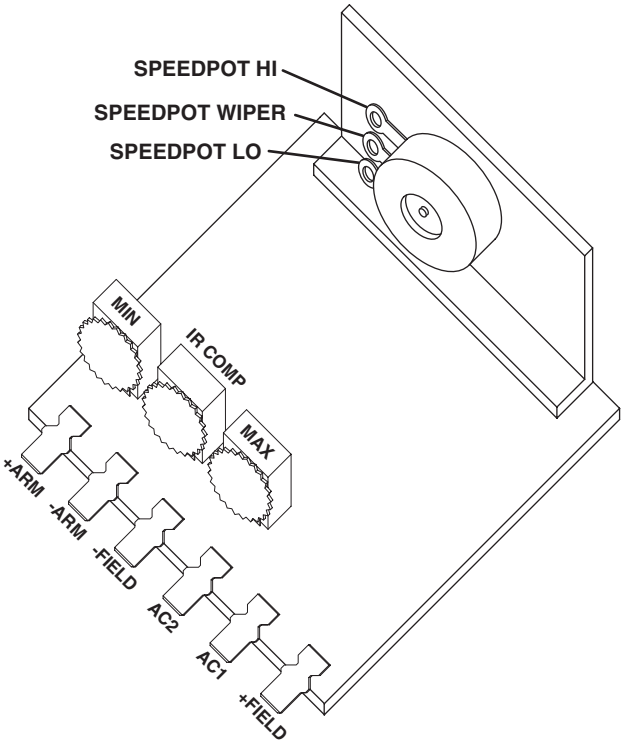
2) Apply power.

3) Rotate the Speedpot fully CW and adjust MAX trimpot in the CW direction until the maximum desired speed is obtained.

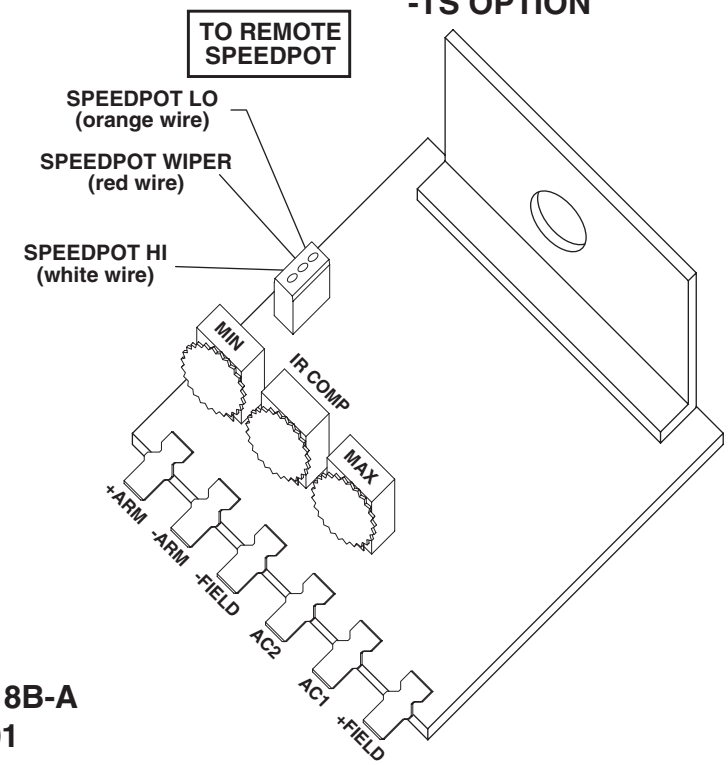
4) Rotate the Speedpot fully counter-clockwise (CCW) and adjust the MIN trimpot in the CW direction until deadband or the minimum desired speed is obtained.

5) The IR COMP trimpot is used as a regulation adjustment. If better motor regulation is needed between minimum and maximum loads, then adjust IR COMP trimpot as follows. Rotate the Speedpot CW to the 50% position and rotate the IR COMP trimpot CW as needed to increase regulation.

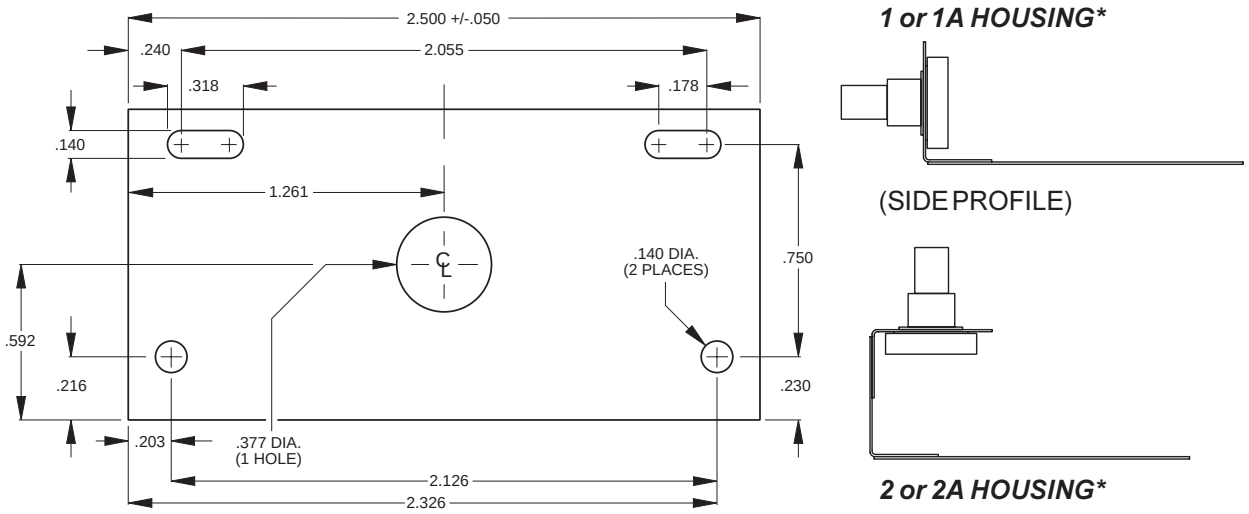
6) Recheck and readjust trimpots if necessary. Trimpot interaction with each other will be minimal.



-TS OPTION



HEATSINK DIMENSIONS & IDENTIFICATION



13DVA Rev.A /15DVA Rev.A MODEL SPECIFICATIONS

AC Input Voltage ..... ± 10% Rated Line Voltage
Amps - DC Output ..... 150mA to 2 Amps
Dimensions ..... 13DV1 / 15DV1: 2.80" wide, 1.30" high, 3.30" deep
..... 13DV2 / 15DV2: 2.80" wide, 1.50" high, 3.30" deep
Input Frequency ..... 50 / 60 Hertz
Input Voltage - 13DV ..... 12 VAC or 24 VAC
- 15DV ..... 120 VAC or 240 VAC
I.R. Compensation ..... Adjustable - full range
Max. Speed ..... Adjustable (40 - 120% of Base Speed)
Min. Speed ..... Adjustable (0 - 30% of Max)
Output Voltage - 13DV (12 or 24 VAC Input) ..... 0-12 or 0-24 VDC
- 15DV (120 or 240 VAC Input) ..... 0-105 or 0-210 VDC
Overload Capacity ..... 200% for 1 minute
Shunt Field Voltage - 13DV ..... 1 Amp max, 10 VDC at 12 VAC
..... 1 Amp max, 20 VDC at 24 VAC
- 15DV ..... 1 Amp max, 100 VDC at 120 VAC
..... 1 Amp max, 200 VDC at 240 VAC
Speed Control ..... 5K Ohm Speed Potentiometer
Speed Range 25:1
Speed Regulation ..... ± 1% of Base Speed
Temperature Range ..... -10° to 45° C. Ambient (15° to 115° F.)
Transient Protection ..... G-Mov
Weight ..... 13DV1A / 15DV1A weighs 2.64 oz.
..... 13DV2A / 15DV2A weighs 3.03 oz.

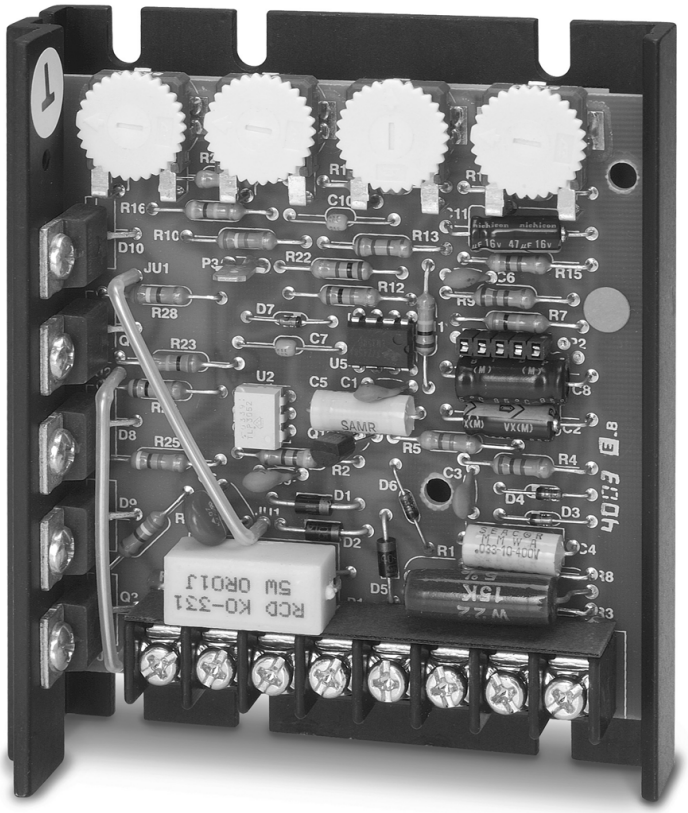
With suitable external heatsink, current can be increased to 4 Amps. The 13DV/15DV heatsink temperature should not exceed 70° C. Equivalent to 4" x 4" x 0.125" thick aluminum plate mounted to housing.

125D CONTROL SERIES

DART CONTROLS

Instruction Manual

Variable Speed Control



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WARRANTY

Dart Controls, Inc. (DCI) warrants its products to be free from defects in material and workmanship. The exclusive remedy for this warranty is DCI factory replacement of any part or parts of such product which shall within 12 months after delivery to the purchaser be returned to DCI factory with all transportation charges prepaid and which DCI determines to its satisfaction to be defective. This warranty shall not extend to defects in assembly by other than DCI or to any article which has been repaired or altered by other than DCI or to any article which DCI determines has been subjected to improper use. DCI assumes no responsibility for the design characteristics of any unit or its operation in any circuit or assembly. This warranty is in lieu of all other warranties, express or implied; all other liabilities or obligations on the part of DCI, including consequential damages, are hereby expressly excluded.

NOTE: Carefully check the control for shipping damage. Report any damage to the carrier immediately. Do not attempt to operate the drive if visible damage is evident to either the circuit or to the electronic components.

All information contained in this manual is intended to be correct, however information and data in this manual are subject to change without notice. DCI makes no warranty of any kind with regard to this information or data. Further, DCI is not responsible for any omissions or errors or consequential damage caused by the user of the product. DCI reserves the right to make manufacturing changes which may not be included in this manual.

WARNING

Improper installation or operation of this control may cause injury to personnel or control failure. The control must be installed in accordance with local, state, and national safety codes. Make certain that the power supply is disconnected before attempting to service or remove any components!!! If the power disconnect point is out of sight, lock it in disconnected position and tag to prevent unexpected application of power. Only a qualified electrician or service personnel should perform any electrical troubleshooting or maintenance. At no time should circuit continuity be checked by shorting terminals with a screwdriver or other metal device.

INTRODUCTION

- **The 123D variable speed control is available in a range of 150mA through 5.5 ADC (or up to 10 ADC if using a suitable external heatsink) at 24 through 36 VAC input.**
- **The 125D variable speed control is available in a range of 150mA through 1/4 H.P. at 120/240 VAC input.**
- **The 125DV variable speed control is available in a range of 1/8 through 1 H.P. at 120/240 VAC input. With -HS(125D) *or* suitable external heatsink (where 125D extrusion temperature does not exceed 70° C.), maximum U.L./C.S.A. rating can be increased to 2 H.P. and 10 Amps DC.**
- **The control is designed for DC Permanent Magnet, Shunt Wound, and some Universal (AC/DC) motors in the above horsepower ranges.**
- **Incoming AC voltage is converted to adjustable full wave rectified DC voltage to operate the DC motor. Also, a full wave field voltage is provided for shunt wound motors (see page 11 for voltages).**
- **The control incorporates transient voltage protection with adjustable current limit which fits into a compact package. It features adjustable minimum and maximum speeds along with adjustable IR compensation and an inhibit function.**
- **Options are available to change ACCEL/DECEL time (see page 8, -15 / -K options).**
- **U.L. Recognized under Standard 508, U.L. File # E78180.**

CONTROL FEATURES

MINIMUM SPEED - Allows adjustment of the motor speed when the speedpot is set at minimum (CCW). This permits the user to eliminate "Deadband" on the main speed control, permitting zero calibration. Clockwise rotation of "MIN" trimpot increases speed.

MAX SPEED (Maximum Speed) - Allows adjustment of the motor speed when the speedpot is set at maximum (CW). This permits the user to eliminate the top end "Deadband", which will provide full speed at maximum rotation. Rotation of the "MAX" trimpot in the clockwise direction increases the maximum motor speed.

I.R. COMP (Speed Regulation) - This allows for adjustment of the circuitry that controls the speed regulation of the motor. The circuitry controls armature speed by changing the armature voltage to compensate for increased or decreased motor loading. Clockwise rotation of the "IR COMP" trimpot will increase compensation.

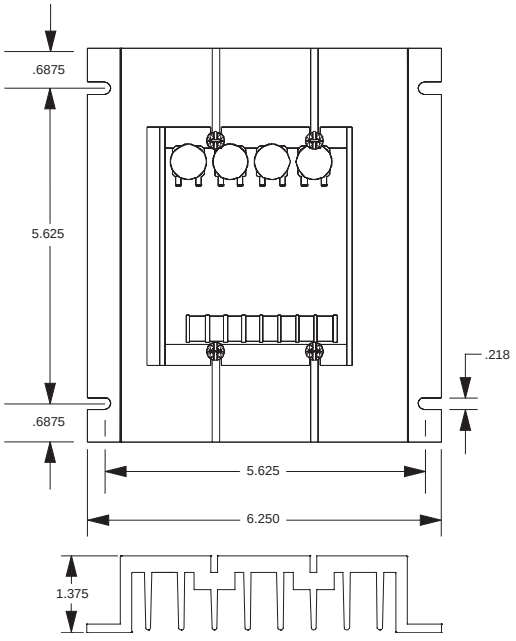
CUR. LIM. (Current Limit) - Provides protection from excessive armature current by limiting the maximum armature current the control can provide. This enables adjustment of the maximum torque the motor can deliver. Torque adjustment (Cur. Lim.) is preset at 125% of rated motor torque (current) based on horsepower. Clockwise rotation of the "CUR. LIM." trimpot increases the torque (current) the control will provide.

INHIBIT TERMINAL PIN - Allows the user a choice of stopping and starting hard (fast) or stopping hard with a soft start through an adjustable acceleration ramp, without breaking the AC lines (see page 6).

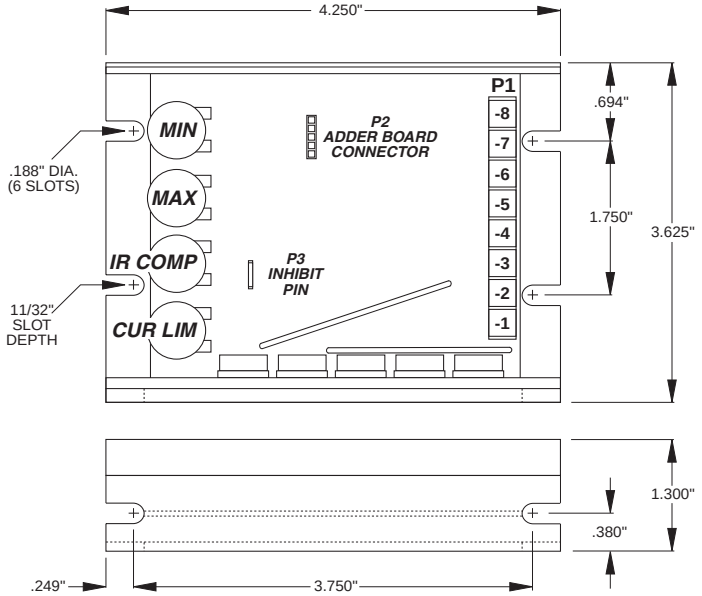
TERMINAL STRIP - Allows for connection of AC lines, motor leads, motor field (if needed), and speed potentiometer

125D SERIES HEATSINK DIMENSIONS

AUXILIARY HEATSINK -HS(125D)



STANDARD HEATSINK



MOUNTING PROCEDURE

1. Six 3/16" wide slots are provided for control mounting.
2. Control chassis can be used as a template.
3. Use standard hardware to mount.

CAUTION:
DO NOT MOUNT WHERE AMBIENT TEMPERATURE IS OUTSIDE THE RANGE OF -10° C (15° F) TO 45° C (115° F)

MODEL SELECTION

HORSEPOWER	INPUT VOLTAGE	OUTPUT VOLTAGE	OUTPUT* AMPS DC	MODEL NUMBER
150mA thru 5.5 A	24 to 36 VAC	0-20 / 0-30 VDC	5.5A	123D-C
1/50 thru 1/8	120/240 VAC	0-90 / 0-180 VDC	1.2A	125D-12C
1/8 thru 1	120/240 VAC	0-90 / 0-180 VDC	5.5A	125DV-C

NOTE: * With -HS(125D) *or* suitable external heatsink (where 125D extrusion temperature does not exceed 70° C.), maximum U.L. and C.S.A. rating for Output Amps can be increased to 10 Amps D.C.

WIRING PROCEDURE & FUSING

1. Size all wires which carry armature or line currents **AS SPECIFIED BY NATIONAL, STATE, AND/OR LOCAL CODES.** All other wires may be # 18 AWG or smaller as permitted by local code.
2. **Separate control wires** from the armature and AC lines when routed in conduit or in wire trays.
3. **Fusing** - The motor and control are protected against overloads by the current limit circuit and a customer installed fuse in the AC line. **THIS PROTECTION ALREADY MAY BE PROVIDED BY THE CUSTOMER WITH CIRCUIT BREAKERS OR FUSES IN BOTH MAIN LINES. IF NOT:**

   FOR 120 VAC INPUT - fuse protection should be added by the customer in AC Line 1 (see following chart)

   FOR 240 VAC INPUT - fuse protection should be added by the customer in AC Line 1 and Line 2 (see following chart)

FUSING ADDED BY CUSTOMER (Bussman ABC or Little Fuse 314 Series ceramic fuses)

HORSEPOWER	120 VAC INPUT	240 VAC INPUT
1/50	2 AMP	---------
1/20	2 AMP	1 AMP
1/8	3 AMP	2 AMP
1/4	4 AMP	3 AMP
1/3	6 AMP	3 AMP
1/2	8 AMP	4 AMP
3/4	12 AMP	6 AMP
1.0	15 AMP	8 AMP
1.5	----------	12 AMP
2.0	----------	15 AMP

NOTE: To determine fusing for the 123D-C Series control (24 to 36 VAC input), use 200% of Full Load Current.

TERMINAL STRIP WIRING INSTRUCTIONS

The 125D Series uses an 8 position terminal strip for ease of connection.

P1-1,2 ***(AC or L)*** ***(AC or N)*** **120 VAC - Connect incoming hot AC or L (black wire) to P1-1 and neutral AC or N (white wire) to P1-2. Connect ground (green wire) to CHASSIS of control.**

240 VAC - Connect both hot sides (L & N), one to P1-1 and one to P1-2. Connect ground wire to CHASSIS of control.

P1-3 ***(+Arm)*** **Connect to PLUS (+) Armature wire on motor. 0-90 VDC for 120 VAC input <u>or</u> 0-180 VDC for 240 VAC input. See "SPECIFICATIONS" for output rating.**

P1-4 ***(-Arm/-Field)*** **Connects to MINUS (-) Armature wire on motor and, if necessary, connect MINUS (-) Field wire of SHUNT WOUND MOTOR.**

(continued of following page)

(continued)

P1-5 ***(+Field)*** **DO NOT use for Permanent Magnet Motor. This supplies +Field voltage for a SHUNT WOUND MOTOR (refer to field voltage table). For motors with dual voltage field (ie. 50/100V or 100/200V), make sure highest value is connected.**

FIELD VOLTAGE TABLE				
VAC INPUT	24	36	120	240
VDC FIELD	20	30	100	200

P1-6 ***(Speedpot Hi)*** **Connects to high side (white wire) of Speedpot (CW end). This is internal +12 volts. For start-stop applications, the connection between this terminal and Speedpot HI can be opened and closed by a SPST switch. INPUT MUST NOT BE GROUNDED!**

P1-7 ***(Speedpot Wiper)*** **Connects to wiper (red wire) of Speedpot (center lead). For Voltage Follower applications, this INPUT MUST NOT BE GREATER THAN +12V MAXIMUM AND MUST NOT BE GROUNDED!**

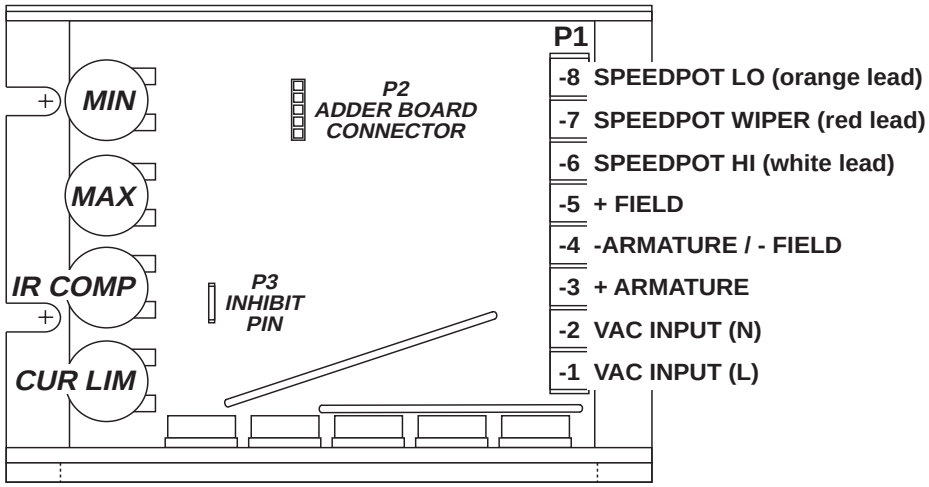
P1-8 ***(Speedpot Lo)*** **Connects to Low side (orange wire) of 5K Speedpot (CCW end). This input is raised and lowered by the MIN. trimpot (5K). Electronic speed input (voltage follower) may be referenced to Speedpot LO if the MIN trimpot adjustments are to be active. Otherwise, inputs may be referenced to -ARM, which will bypass the MIN trimpot. INPUT MUST NOT BE GROUNDED!**

Warning:

1. **Be sure the control housing is properly grounded.**
2. **Armature connections must not be switched or broken while the control is on. Serious control damage may result.**
3. **For non-speedpot applications, the input connection to the LO, WIPER, and HI terminals must not be grounded! Serious control damage may result from a grounded input.**

123D/125D HOOK-UP DIAGRAM

Warning:
Do not attempt to perform Hi-pot test across AC lines with control in circuit. This will result in immediate or long term damage to the control.



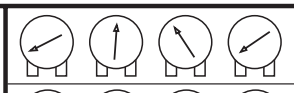
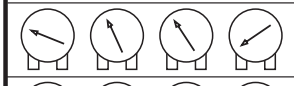
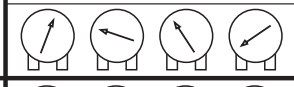
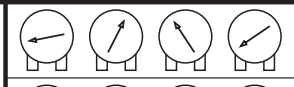
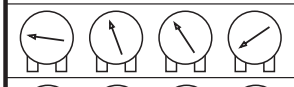
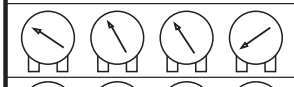
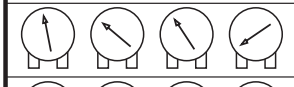
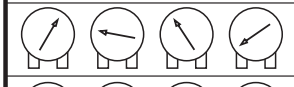
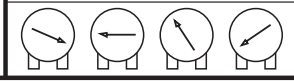
CONTROL START-UP

WARNING: ALL POWER MUST BE TURNED OFF BEFORE PROCEEDING!

1. Recheck all wiring. Accidental grounds, loose or pinched wires on armature or speedpot wires may damage the control when power is applied.
2. Check to see that incoming service is of correct voltage.
3. Turn speedpot to zero (fully CCW).
4. Turn power on, and advance speedpot while observing motor. **Power must be off before step 5 can be accomplished!**
5. If motor rotation is incorrect, turn power off at external disconnect and reverse +ARM and -ARM connections.
6. Check for satisfactory operation throughout the speed range.
7. If operation is satisfactory, no readjustments are needed.
8. If instability or surging is observed, or if maximum speed is higher than desired, see "TRIMPOT ADJUSTMENT CHART " on page 5.
9. For other problems, consult page 10, “IN CASE OF DIFFICULTY”.

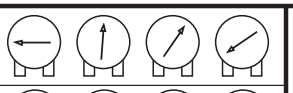
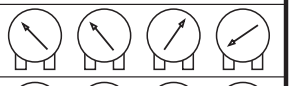
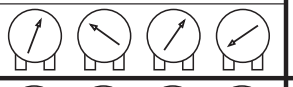
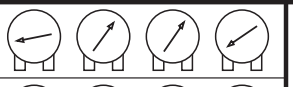
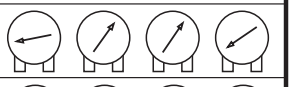
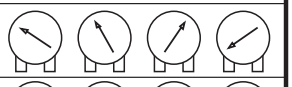
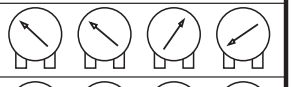
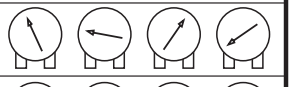
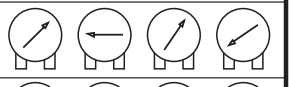
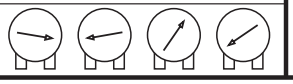
TRIMPOT ADJUSTMENT CHART & PROCEDURE

Settings apply when using a 5K ohm master speedpot. This chart is used in conjunction with the adjustment procedure and is approximate.

	C.L.	I.R.	MAX	MIN	HP
125D-12C 120 VAC input; 0-90 VDC output					**1/50**
					**1/20**
					**1/8**
125DV-C 120 VAC input; 0-90 VDC output					**1/8**
					**1/4**
					**1/3**
					**1/2**
					**3/4***
					**1.0***

Operation of the control beyond ±10% of the normal line voltage could result in re-adjustment. These adjustments are permanent; periodic re-adjustment is normally not needed.

Settings apply when using a 5K ohm master speedpot. This chart is used in conjunction with the adjustment procedure and is approximate.

HP	C.L.	I.R.	MAX	MIN	
1/20					**125D-12C** 240 VAC input; 0-180 VDC output
1/8					
1/4					
1/4					**125DV-C** 240 VAC input; 0-180 VDC output
1/3					
1/2					
3/4*					
1.0*					
1.5*					
2.0*					

*** NOTE: ADDITIONAL CUSTOMER HEATSINK REQUIRED FOR 125DV-C (120 VAC INPUT - GREATER THAN 1/2 H.P. MOTORS) AND (240 VAC INPUT - GREATER THAN 1 H.P. MOTORS). 125 EXTRUSION TEMPERATURES SHOULD NOT EXCEED 70 DEGREES C.**

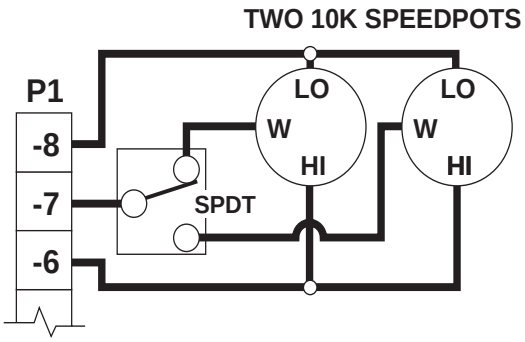
NOTE: FOR DETERMINING TRIMPOT SETTINGS FOR THE 123D-C SERIES, SEE TRIMPOT SETTINGS PROCEDURE BELOW.

TRIMPOT	FUNCTION	ADJUSTMENT
MIN.	Sets minimum motor speed when speedpot is set at zero. CW rotation will increase minimum motor speed.	1. Set Speedpot to zero (fully CCW). 2. Rotate MIN trimpot CW until motor starts to rotate. 3. Slowly rotate MIN trimpot CCW until motor stops. NOTE: If motor rotation is desired, rotate MIN trimpot CW until desired MIN speed is reached.
IR COMP	Provides a means of improving motor speed regulation in the armature feedback mode. If a slowdown due to load change is of no concern, rotate this trimpot fully CCW.	1. Set Speedpot at 50%. 2. Observe motor speed at no load condition. 3. Apply full load to motor. 4. Turn IR COMP trimpot CW to obtain the same motor speed as with no load.
MAX.	Sets maximum motor speed when speedpot is set at maximum (fully CW rotation). CW rotation of MAX trimpot increases maximum motor speed.	1. TURN DRIVE POWER OFF!! 2. Connect a DC Voltmeter: + to +ARM, - to -ARM. **NOTE: Meter must not be grounded!!** 3. Set meter voltage range: (90 VDC for 120 VAC, 180 VDC for 240 VAC). 4. Turn power on. Set Speedpot at 100%. 5. Adjust MAX trimpot to rated motor armature voltage as shown on meter. NOTE: A tachometer or strobe may be used in lieu of a meter. Follow above steps, except adjust MAX trimpot to rated motor base speed indicated by tachometer or strobe.
CUR.LIM.	Limits DC motor armature current (torque) to prevent damage to the motor or control. The current limit is set for the rated motor current. CW rotation of this trimpot increases the armature current (or torque produced).	1. TURN DRIVE POWER OFF! 2. Connect a DC Ammeter between A1 on motor and +ARM on control. This is in series with the motor. 3. Turn power on. 4. Set Speedpot at the 50% position. 5. Apply friction braking to motor shaft until motor stalls. 6. With motor stalled, set current at 125% of rated motor armature current by adjusting CUR. LIM . trimpot.

CONTROL MODIFICATIONS

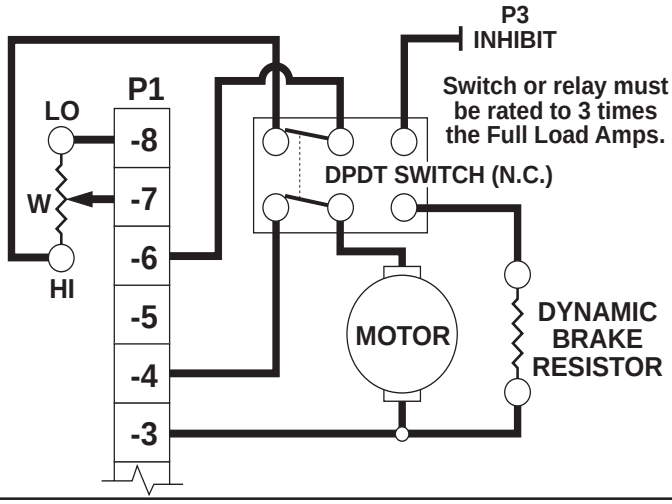
TWO SPEED OPERATION

Two pot operation is done using two 10K ohm speed potentiometers in parallel (both HI's to P1-6, both LO's to P1-8). The WIPER is switched using a SPDT switch.



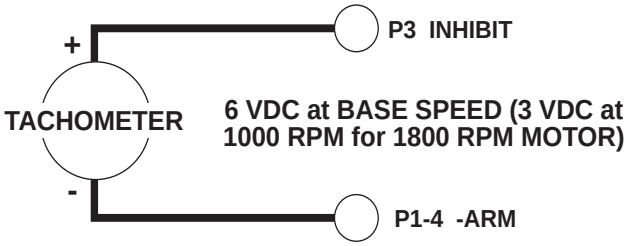
DYNAMIC BRAKING

A DPDT switch is used to inhibit the control and to connect the DBR. Typical values for the DBR (dynamic brake resistor) are 5 ohms for 120V, 10 ohms for 240V (both 35W to 50W). Note that motor horsepower, inertia, and cycle time effect sizing of the DBR. NOTE: This modification cannot be used with any of the -15 options.



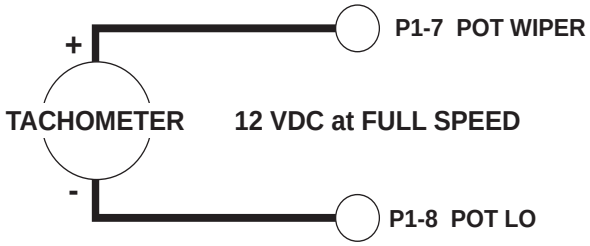
TACHOMETER FEEDBACK

Improves speed regulation to ±1/2% of base speed.



TACHOMETER FOLLOWER

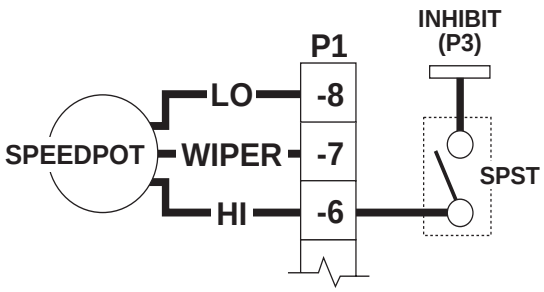
Allows control output to follow tachometer voltage.



NOTE: NEED 1% OR LESS - TACH OUTPUT RIPPLE

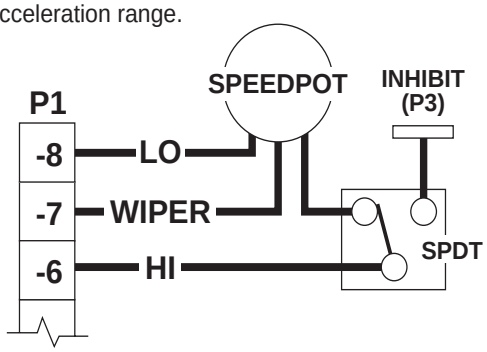
INHIBIT (USED INDEPENDENTLY)

The customer supplied SPST switch is connected in series between the speedpot HI (P1-6) and the Inhibit pin (P3). To inhibit (stop motor), speedpot HI is closed to the Inhibit pin. To restart, the switch is returned to open. NOTE: The control will stop and start fast.



INHIBIT (USED WITH SPEEDPOT)

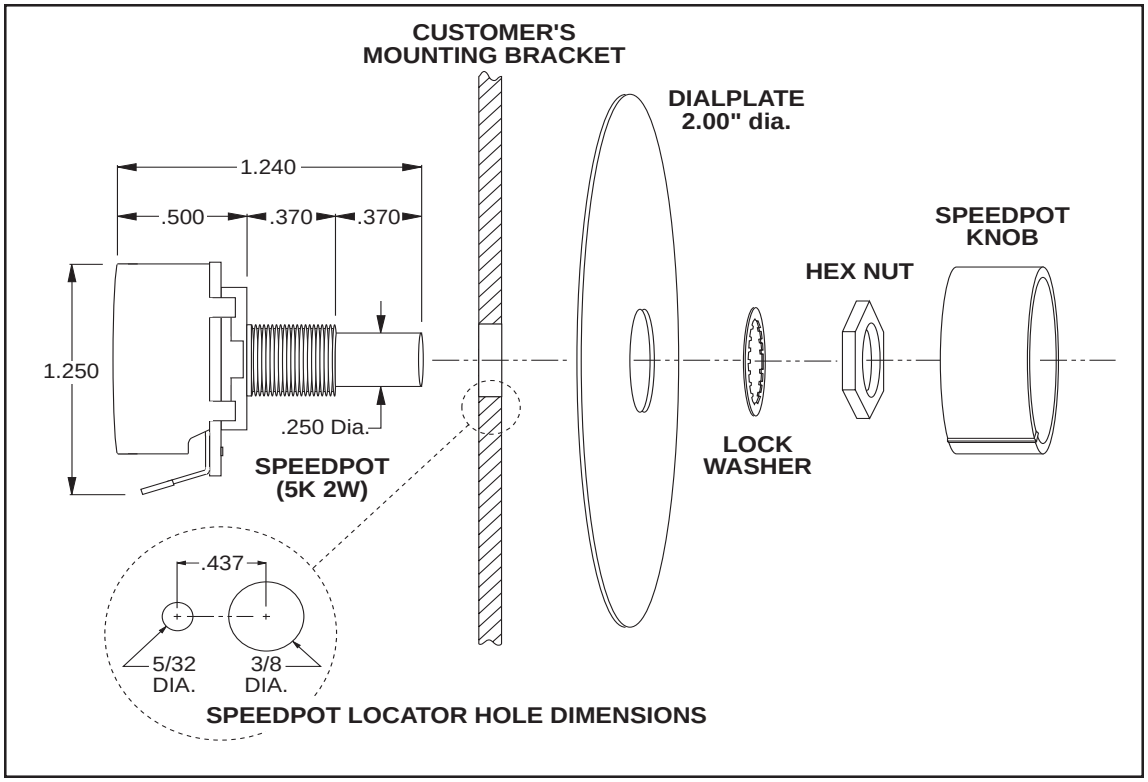
The Common of the SPDT switch is connected to control pot HI and is switched between Speedpot Hi and the Inhibit pin (P3). To inhibit (stop motor), speedpot HI is closed to the Inhibit pin. To restart, the switch is returned to Speedpot Hi. NOTE: The control will stop fast and soft start through a fixed acceleration range.



NOTE: Permits starting and stopping of motor without breaking AC lines. In the event of SCR failure or false triggering, the Inhibit circuit will not stop motor.

Always use a shielded wire when connecting to the inhibit terminal. The shield should be connected to -Armature or Common of the control.

SPEEDPOT KIT ASSEMBLY



OPTION DESCRIPTIONS

-1 option

Field or Factory Installed

Electronic Speedpot Interlock — **Available All Models**

The -1 adder board connects to the 125 series board through use of a female connector and plastic standoff support.

When incoming AC power to the control is applied, the Electronic Interlock will prevent the motor from starting until the speedpot is first rotated to the zero position and then rotated clockwise toward the set speed.

Also, should the incoming AC power be interrupted for any reason, then restored, the Electronic Interlock will prevent an automatic restart of the motor. To restart, the speedpot must first be rotated to the zero position and then rotated clockwise toward the set speed.

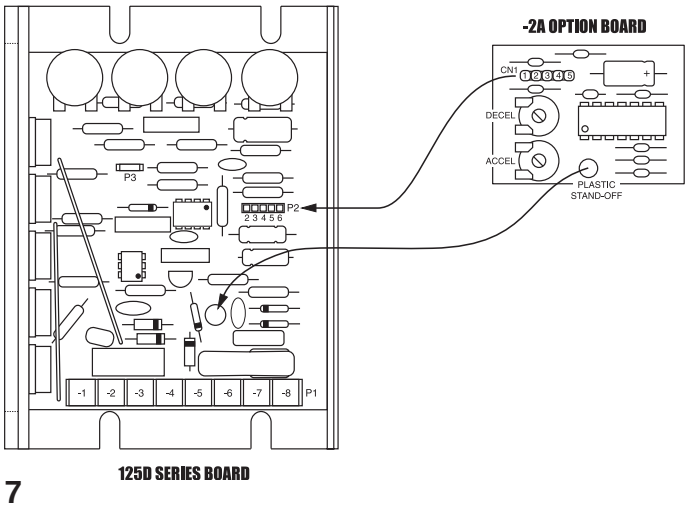
CAUTION: The Electronic Interlock becomes inoperative if SCR failure should occur.

-2A option

Field or Factory Installed

Individually Adjustable Linear Accel and Decel — **Available All Models**

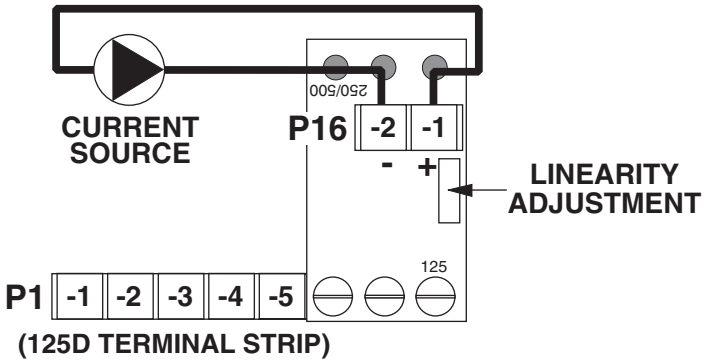
This option plugs into the five position expansion connector on the 125D main board. The -2A option overrides the fixed accel ramp built into the 125D control, providing independently adjustable linear accel and decel from 0.5 to 8.0 seconds. To install, flip over the -2A option board so the printed circuit lines are visible. Align the male connector CN1 (-2A option) with the female connector P2 (125D board) so terminal CN1-1 fits into P2-6, CN1-2 in P2-5, etc. Align the plastic stand-off on the -2A option board with the hole shown on the 125D main board. Once connectors and stand-off are aligned, snap into place. Adjustment of both trimpots is accomplished via the labeled access holes on the back side of the -2A option board. Full CCW rotation equals minimum accel or decel time and full CW rotation equals maximum accel or decel time. Note: Each trimpot operates independently of the other.



-5 option

Isolated 4-20 ma.Signal Follower — **Field or Factory Installed** / **Available All Models**

4 to 20 mA ..... -5



DO NOT USE TRIMPOT CHART TO ADJUST MIN AND MAX TRIMPOTS ON MAIN BOARD. IF ADJUSTMENT IS NEEDED THEN REFER TO THE SETUP PROCEDURE BELOW.

This option replaces the speedpot with a 4-20 ma. signal to control speed. The current signal input can be either grounded or ungrounded. The board sets on spacers screwed to terminals P1-6, P1-7, and P1-8 on the main board using long screws. The current source connects to the + and - two position terminal strip (P16-1 and -2) on the -5 option board.

The Linearity trimpot on the -5 option board is set at the factory for proper linearity, however this trimpot may need to be re-set after tuning the controls Max and Min trimpot settings for your specific application. If needed then refer to the setup procedure below.

Setting the Min, Max and Linearity Trimpots.

1. Preset the multi-turn Linearity trimpot on the –5 option board full CW, set the Min trimpot full CCW and set the Max trimpot at about 50% rotation.
2. Input a 4 ma. current signal to the control and turn the Min trimpot CW to your desired minimum output voltage or to deadband (the point just before you begin to get an output).
3. Input a 20 ma. current signal to the control and set the Max trimpot to the desired maximum speed setting.
4. With 20 ma. still going to the control, turn the Linearity trimpot CCW until your output speed starts to decrease. Then slowly turn it back CW until you just reach your maximum speed setting.

-7 option

Isolated 4-20 ma. Signal Follower with Auto / Manual Switch — **Field or Factory Installed** / **Customer Wired**

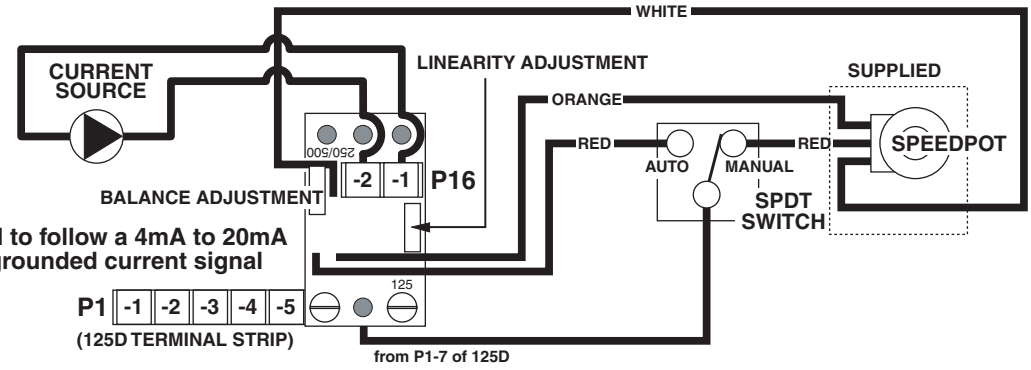
DO NOT USE TRIMPOT CHART TO ADJUST MIN AND MAX TRIMPOTS ON MAIN BOARD. IF ADJUSTMENT IS NEED THEN REFER TO THE SETUP PROCEDURE BELOW.

This option allows the control to be run in either the Manual mode via a speed pot or the Auto mode via the 4-20 ma. signal. The current signal input can be either grounded or ungrounded. The board sets on spacers screwed to terminals P1-6, P1-7, and P1-8 on the main board using long screws. The current source connects to the + and - two position terminal strip (P16-1 and -2) on the -7 option board.

This option includes a Balance trimpot which is used to scale the maximum speed in the manual mode. It is factory set so the maximum speed in manual equals the maximum speed in automatic.

The Linearity trimpot on the -7 option board is set at the factory for proper linearity, however this trimpot may need to be re-set after tuning the Max and Min trimpot settings on the control or if the Balance trimpot on the –7 must be reset for your specific application. If needed then refer to the setup procedure below.

4 to 20 mA.... -7



Setting the Min, Max, Balance and Linearity Trimpots.

1. Preset the multi-turn Linearity trimpot and the Balance trimpot on the –7 option board full CW, set the Min trimpot full CCW and set the Max trimpot at about 50% rotation.
2. Input a 4 ma. current signal to the control and turn the Min trimpot CW to your desired minimum output voltage or to deadband (the point just before you begin to get an output).
3. Input a 20 ma. current signal to the control and set the Max trimpot to the desired maximum speed setting.
4. Switch the control to the Manual mode setting and adjust the Balance trimpot CCW as needed to attain your required manual mode maximum output speed. (Adjustable form 50 to 100% of maximum Auto mode setting)
5. Switch the control back to Auto mode. With 20 ma. still going to the control, turn the Linearity trimpot CCW until your output speed starts to decrease. Then slowly turn it back CW until you just reach your maximum speed setting.

-11 option

Field Installed

10 Turn Master SpeedPot — **Available All Models**

Provides finer control of speed. Use standard Hook-up directions and Trimpot Chart (page 5).

-15B / -K options

Acceleration Time Ranges — **Factory Installed**

This option provides the Accel times shown below. The standard Accel time is 0.5 seconds.

	-15B OPTION	-K OPTION
ACCELERATION TIME	4 seconds	6 seconds

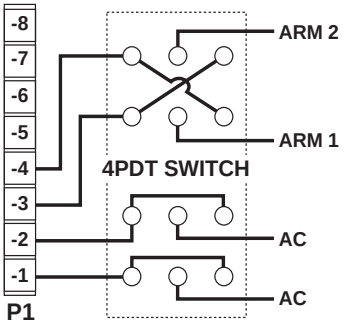
USE STANDARD HOOK-UP

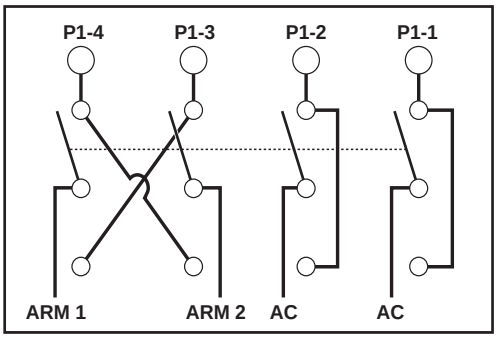
-29B option

Manual Forward-Off-Reverse Switch — **Field Installed Only**

Permits reversing of motor. This is accomplished using a 4PDT blocked center switch. When switched between the forward/reverse positions, a delay is encountered due to the blocked center position, which protects the control from any voltage that may be at the ARM terminals. The center position is OFF/NEUTRAL.

THE MOTOR MUST COME TO A COMPLETE STOP BEFORE CHANGING DIRECTIONS. IF THE MOTOR DOES NOT COME TO A COMPLETE STOP, SERIOUS DAMAGE TO THE CONTROL MAY RESULT. BYPASS OF THE SWITCH CENTER BLOCK MAY RESULT IN DAMAGE TO THE CONTROL.





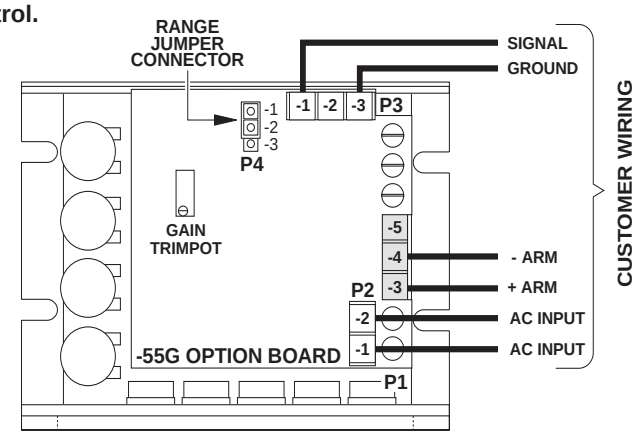
-55G option

Isolated Voltage Input — Factory or Field Installed

NOTE: This option cannot be used on the 123D-C series control.

This option permits either a grounded or non-grounded remote DC voltage speed command. This DC input can range from 0-5VDC through 0-25VDC or 0-25VDC through 0-250VDC (which can be selected via the range jumper clip and adjusted with the GAIN trimpot). The output of this option board supplies a linear pulse width modulated signal to the control that is proprotional to the input signal supplied to the option board. The option replaces the 5K speedpot. Input impedance is 1.2M ohms on high scale, and 150K ohms on low scale.

NOTE: Range jumper connector is used to select input voltage range. When installed from P4-1 to P4-2, the range is 0-25VDC through 0-250VDC; when installed from P4-2 to P4-3, range is 0-5VDC through 0-25VDC.



(FOR SHUNT WOUND MOTOR, SEE PAGE 4 OF MANUAL FOR FIELD CONNECTIONS).

CAUTION: DO NOT use TRIMPOT ADJUSTMENT CHART. Set pots using directions in following SET-UP PROCEDURES.

SETUP PROCEDURE FOR -55G AND -56G OPTIONS

1. With **NO** power to control, connect a DC Voltmeter (meter must not be grounded) to control outputs as follows: Meter COMMON to the -ARM terminal, Meter POSITIVE to the +ARM terminal. Select correct meter range (0-90V or 0-180V).
2. Preset GAIN trimpot on option board fully CCW, place range jumper clip in proper position.
3. Preset control as follows: MIN, MAX & IR fully CCW, and Current Limit fully CW.
4. Apply AC power of correct voltage to control and option board.
5. With 0 volts into option board, adjust MIN trimpot of control to eliminate deadband. To do this, increase MIN fully CW, then adjust CCW until meter reads 0 volts.
6. Apply maximum input voltage to option board input. Motor will start to rotate.
7. Adjust GAIN until no further change in control output voltage occurs, back off approximately 1 turn, then set control MAX. setting to 90 VDC (180VDC for 240V units).
8. Current Limit is set as shown on "TRIMPOT ADJUSTMENT CHART" on page 5.
9. For Closed Looped systems the IR should remain fully CCW. For Open Looped systems, set IR as needed

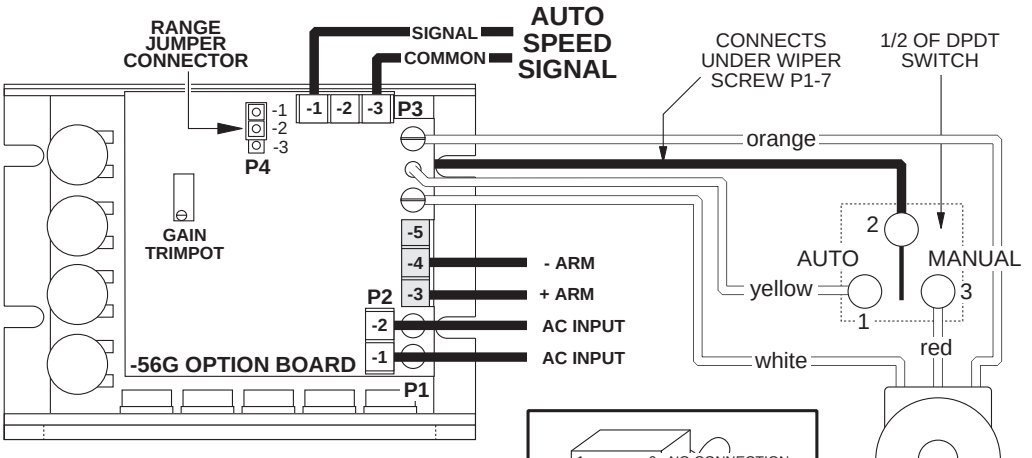
-56G option

Isolated Voltage Input with Auto / Manual Switch — Factory or Field Installed

NOTE: This option cannot be used on the 123D-C series control.

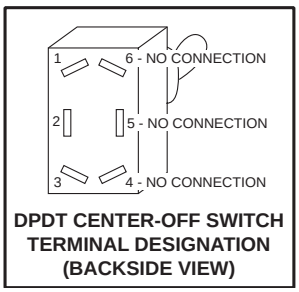
This option permits either a grounded or non-grounded remote DC voltage speed command. This DC input can range from 0-5VDC through 0-25VDC or 0-25VDC through 0-250VDC (which can be selected via the range jumper clip and adjusted with the GAIN trimpot). The output of this option board supplies a linear pulse width modulated signal to the control that is proprotional to the input signal supplied to the option board. The option replaces the 5K speedpot. Input impedance is 1.2M ohms on high scale, and 150K ohms on low scale.

(FOR SHUNT WOUND MOTOR, SEE PAGE 4 OF MANUAL FOR FIELD CONNECTIONS).



NOTE:
Range jumper connector is used to select input voltage range. When installed from P4-1 to P4-2, the range is 0-25VDC through 0-250VDC; when installed from P4-2 to P4-3, range is 0-5VDC through 0-25VDC.

= CUSTOMER WIRING
= FACTORY WIRING



DPDT CENTER-OFF SWITCH TERMINAL DESIGNATION (BACKSIDE VIEW)

CAUTION: DO NOT use TRIMPOT ADJUSTMENT CHART. Set pots using directions in following SET-UP PROCEDURES.

IN CASE OF DIFFICULTY

PROBLEM	POSSIBLE CAUSE(S)	CORRECTIVE ACTION(S)
Motor doesn't operate	**- Blown Fuse**	**Replace Fuse**
	- Incorrect or no power source	**Install proper service**
	- Speedpot set at Zero	**Adjust Speedpot CW to start**
	- Worn motor brushes	**Replace brushes**
Armature output voltage cannot be adjusted, output is a constant DC level	**- No motor or load connected**	**Check that motor or load is connected to armature terminals**
	- Speedpot low connection open	**Check that speedpot low wire is connected**
Motor stalls, or runs very slowly with speed control turned fully CW	**- Low Voltage**	**Check-should be above 100V or 208 V**
	- Overload Condition	**Reduce load**
	- Worn motor brushes	**Replace brushes**
	- MAX SPEED set incorrectly	**See ADJUSTMENT PROCEDURE**
Motor hunts	**- Motor current less than 150mA**	**Motor current must be greater than 150mA D.C.**
	- Too much IR COMP	**See ADJUSTMENT PROCEDURE**
	- Motor is in current limit	**See ADJUSTMENT PROCEDURE**
	- Motor speed is above rated speed	**Reduce Speed**
	- Max set too high	**See ADJUSTMENT PROCEDURE**
Repeated fuse blowing	**- Low Voltage**	**Check-should be above 100V or 208V**
	- Overload Condition	**Reduce load**
	- Worn motor brushes	**Replace**
	- Defective motor bearings	**Replace**
	- Defective electrical components	**Call Dart Distributor or Representative**

If control still will not operate, consult your Dart Distributor or Representative.

SPECIFICATIONS

AC input voltage ..... ±10% of rated line voltage
Acceleration ..... 0.5 seconds (standard 125D)
Amps - DC output ..... 150 mA to 5.5 ADC*
Controller overload capacity ..... 200% for one minute
Current limit trimpot range ..... 0.3 to 2.5 ADC (125D); 1 to 15 ADC (123D & 125DV)
Deceleration ..... 0.5 seconds (standard 125D)
Dimensions and weights:

	WIDTH	LENGTH	DEPTH	WEIGHT
ENGLISH	3.625"	4.250"	1.300"	8.00 oz.
METRIC	92mm	108mm	33mm	228 gms.

Drive service factor 1.0
Efficiency ..... 85% typical
Input frequency ..... 50 or 60 Hertz
Max. trimpot speed range ..... 60% to 110% of base speed
Min. trimpot speed range ..... 0% to 30% of maximum speed
Power devices ..... isolated case tab
Shunt field voltage ..... 20VDC for 24VAC input; 30VDC for 36VAC input; 100VDC for 120VAC input; 200VDC for 240VAC input; 1 amp maximum
Speed control ..... via 5Kohms 2W potentiometer or 0-10VDC isolated signal
Speed range 50:1
Speed regulation ..... ±1% of base speed
Temperature range ..... -10° to 45° C. ambient (15° to 115° F.)
Transient protection ..... G-Mov**
Trigger ..... opto-coupler
Type ramp of accel/decel ..... RC time constant

* With -HS(125D) *or* suitable external heatsink (where 125D extrusion temperature does not exceed 70° C.), maximum U.L. rating for output amps can be increased to 10 amps D.C.

** not used on the 123D-C series control

TYPICAL MOTOR CURRENTS

Horsepower	1/50	1/20	1/8	1/4	1/3	1/2	3/4	1.0	1.5	2.0
Typical AC Amps (120VAC)	0.50	1.00	2.00	3.50	4.40	6.50	9.30	13.20	-----	-----
Typical Arm Amps (120VAC)	0.42	0.81	1.60	2.70	3.40	5.00	8.20	10.90	-----	-----
Typical AC Amps (240VAC)	-----	0.80	1.20	1.80	2.20	3.30	4.80	6.50	9.70	12.90
Typical Arm Amps (240VAC)	-----	0.40	0.60	1.40	1.70	2.50	3.70	5.00	8.20	11.60

125D SERIES PARTS PLACEMENT & LIST

RESISTORS

R1	15K 6W
R2	470 Ω
R3	2.7K
R4	2.7K
R5	82K
R6	5K (MIN TRIM)
R7	300K
R8	180K
R9	1.2M
R10	39K
R11	100K
R12	10K
R13	2.2K
R14	820 Ω
R15	4.7K
R16	470K
R17	1K
R18	100 Ω (I.R. TRIM)
R19	5K (C.L. TRIM)
R20	300K
R21	10K (MAX TRIM)
R22	1K
R23	300K
R24	.01 Ω 5W
R25	91K
R26	1K
R27	390 Ω
R28	390 Ω
R29	5K SPEEDPOT *

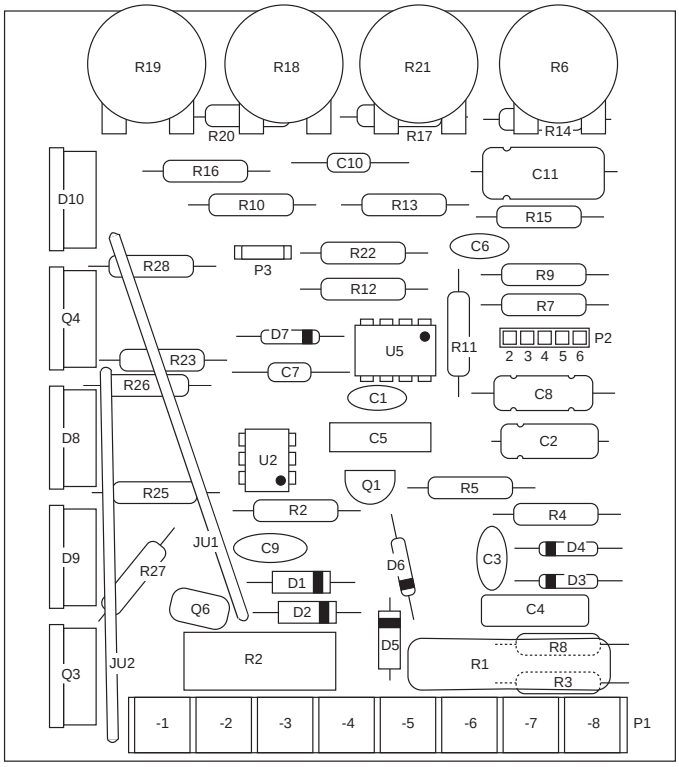
ACCEL CHANGES

Replace N.P. cap with polarized cap (see above)

-15A ... C8 ... 33uf 16V
-15B ... C8 ... 15uf 25V
-15C ... C8 ... 4.7uf 16V
- K ..... C8 ... 22uf 16V

125D-12C (1/50 thru 1/8 H.P.) CHANGES:

R24 ..... .062 Ω 5W



MISCELLANEOUS

JU1	18GA. SOLID INSULATED WIRE
JU2	18GA. SOLID INSULATED WIRE
PCB	A-4-2033F PRINTED CIRCUIT
P1 (-1 THRU -8)	8 POS. TERMINAL STRIP
P2 (-2 THRU -6)	5 POS. FEMALE CONNECTOR
P3	3/16" MALE SPADE PIN

ACTIVE DEVICES

Q1	2N6027
U2	3052 MOC
Q3	S4015L
Q4	S4015L
U5	LM358 IC
Q6	275V G-MOV

CAPACITORS

C1	.01µF 100V
C2	10µF 35V
C3	.01µF 100V
C4	.033µF 400V
C5	.22µF 1KV
C6	.001µF 1KV
C7	.1µF 50V
C8	1µF 50V N.P.
C9	.0047µF 1KV
C10	.1µF 50V
C11	47µF 16V

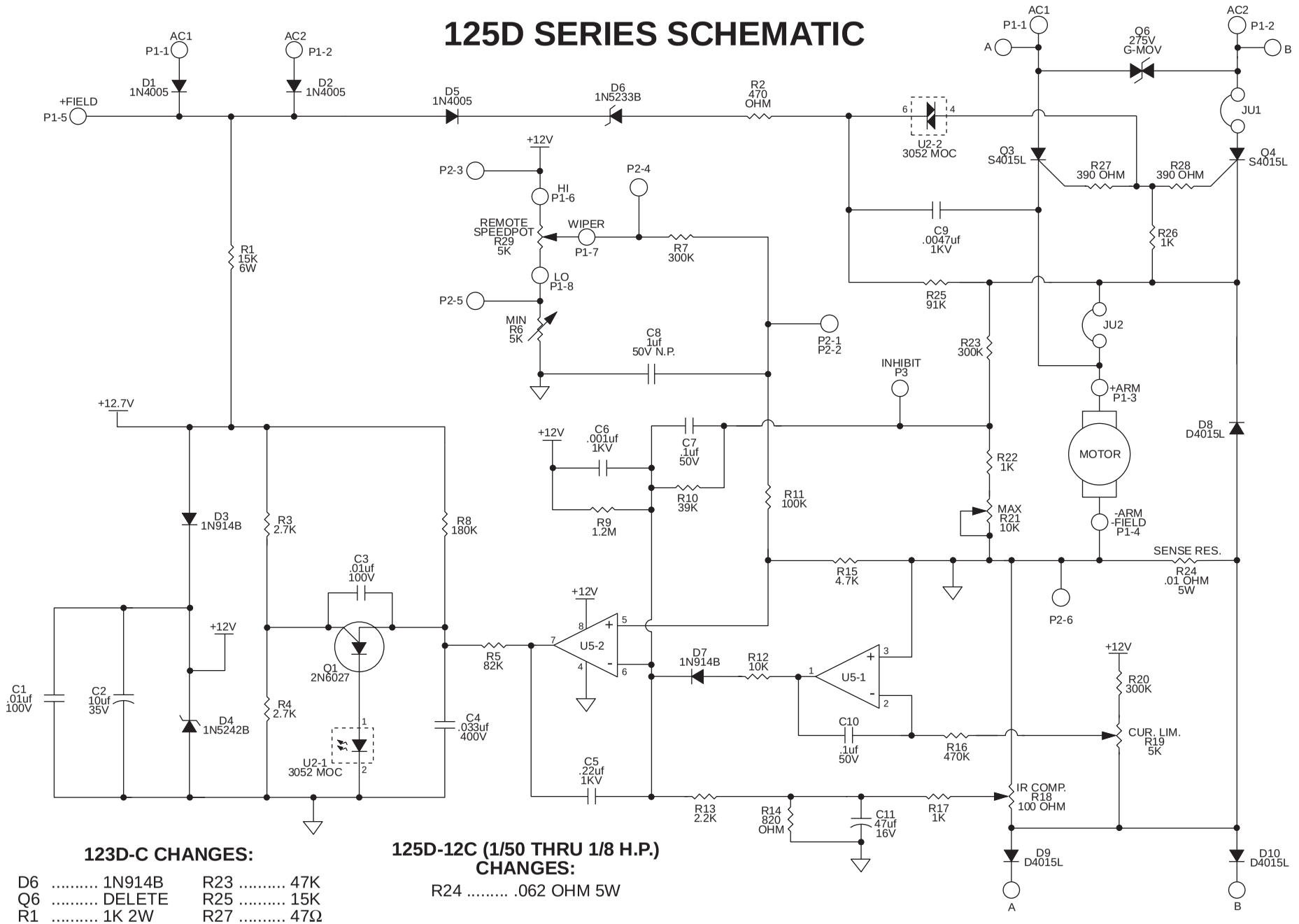
DIODES

D1	1N4005
D2	1N4005
D3	1N914B
D4	1N5242B
D5	1N4005
D6	1N5233B
D7	1N914B
D8	D4015L
D9	D4015L
D10	D4015L

123D-C CHANGES:

D6	1N914B (reverse direction)
Q6	DELETE
R1	1K 2W
R2	47Ω
R16	220K
R23	47K
R25	15K
R27	47Ω
R28	47Ω

125D SERIES SCHEMATIC



123D-C CHANGES:

D6 ..... 1N914B	R23 ..... 47K
Q6 ..... DELETE	R25 ..... 15K
R1 ..... 1K 2W	R27 ..... 47Ω
R2 ..... 47Ω	R28 ..... 47Ω
R16 ..... 220K	

125D-12C (1/50 THRU 1/8 H.P.) CHANGES:

R24 ..... .062 OHM 5W

NOTES:

U5 ..... LM358 IC

REPAIR PROCEDURE

In the event that a Product manufactured by Dart Controls Incorporated (DCI) is in need of repair service, it should be shipped, freight paid, to: Dart Controls, Inc., 5000 W. 106th Street, Zionsville, IN. 46077, ATTN: Repair Department.

Please include with each order a P.O. number to cover any repair charges (a P.O. is needed even on warranty returns to cover misuse or other failures that have voided warranty), and include a note with a brief description of the problem experienced. NO WORK WILL BE DONE ON ANY ORDER WITHOUT A P.O. NUMBER.

Completed repairs are returned with a Repair Report that states the problem with the control and the possible cause. Repair orders are returned via UPS Ground unless other arrangements are made. If you have further questions regarding repair procedures, contact your Dart Distributor or Representative.

YOUR MOTION SYSTEMS SOLUTION PROVIDER

125D SERIES
AC INPUT - VARIABLE DC OUTPUT
1/50 HP through 1.0 HP

250G SERIES
AC INPUT - VARIABLE DC OUTPUT
1/50 HP through 2.0 HP

65 SERIES
DC INPUT - VARIABLE DC OUTPUT
CURRENT RATINGS OF 20, 40, AND 60 AMPS

700/COMMUTROL SERIES
DC BRUSHLESS
5 & 20 Amp for
12,24,& 36VDC Inputs

MDP SERIES
PROGRAMMABLE
CLOSED LOOP DC
SPEED CONTROL

DM SERIES
FIELD PROGRAMMABLE
DIGITAL TACHOMETER

Dart Controls, Inc. is a designer, manufacturer, and marketer of analog and digital electronic variable speed drives, controls, and accessories for AC, DC, and DC brushless motor applications.

Shown above is just a sampling of the expanded line of Dart controls that feature the latest in electronic technology and engineering. Products are manufactured in the U.S.A. at our Zionsville (Indianapolis, Indiana) production and headquarters facility - with over 2,000,000 variable speed units in the field.

In addition to the standard off-the-shelf products, you can select from a wide variety of options to customize controls for your specific application. For further information and application assistance, contact your local Dart sales representative, stocking distributor, or Dart Controls, Inc.

Dart Controls, Inc.

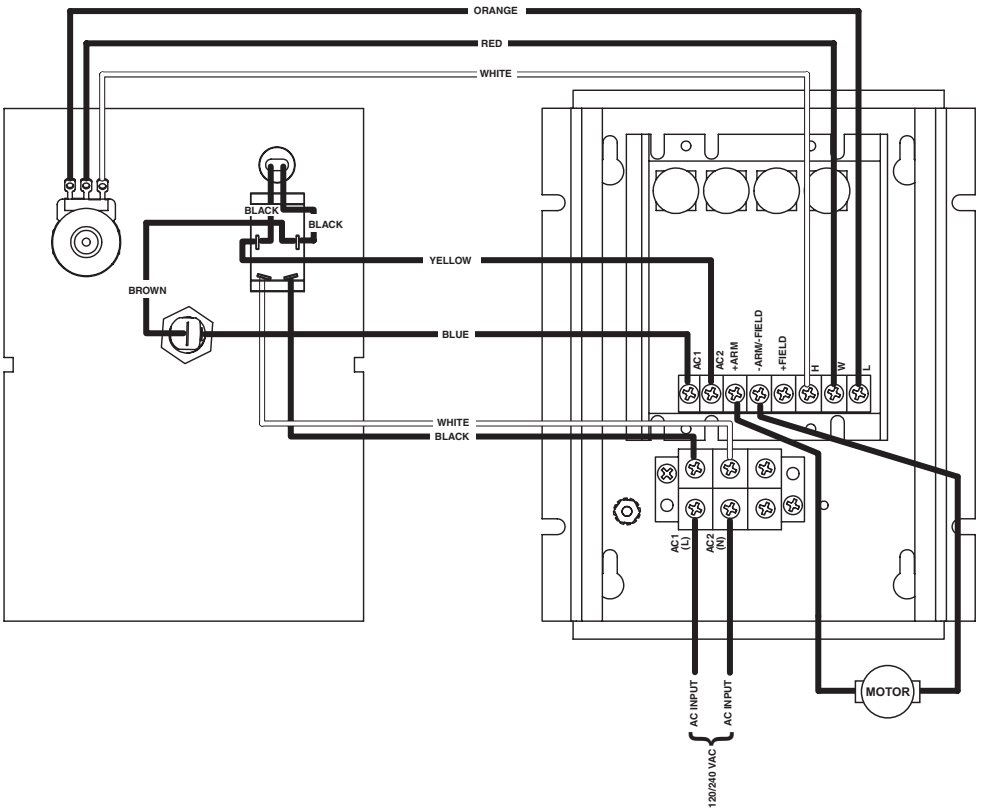
Manufacturer of high quality DC and AC motor speed controls and accessories since 1963.

P.O. Box 10
5000 W. 106th Street
Zionsville, Indiana 46077
Phone: (317) 733-2133
Fax: (317) 873-1105

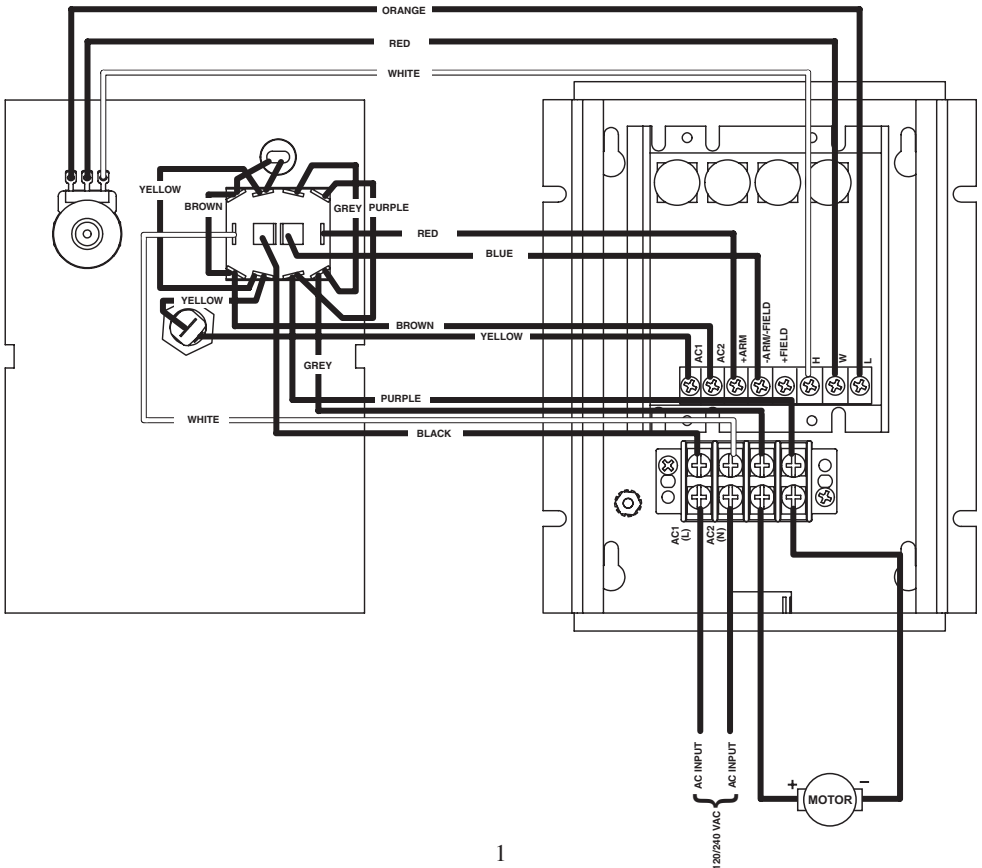
www.dartcontrols.com
ISO9001 REGISTERED

125DVE ADDER SHEET

125DVE Standard Hook-Up



125DVE-29 Reversing Hook-Up



125DVE SPECIFICATIONS

AC input voltage ····· ±10% of rated line voltage
Acceleration ····· 0.5 seconds (standard 125D)
Amps - DC output ····· 150 mA to 5.5 ADC
Controller overload capacity ····· 200% for one minute
Current limit trimpot range ····· 1 to 15 ADC (125DVE)
Deceleration ····· 0.5 seconds (standard)
Dimensions and weights:

	WIDTH	LENGTH	DEPTH	WEIGHT
ENGLISH	6.016”	7.630”	6.845”	2.61 lb.
METRIC	153mm	194mm	174mm	1.18 kg.

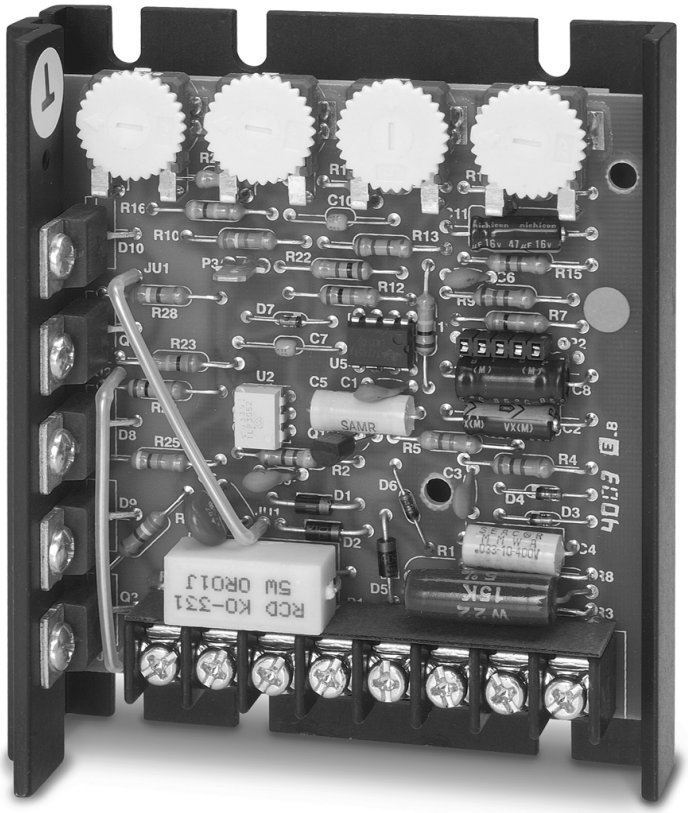
Drive service factor ····· 1.0
Efficiency ····· 85% typical
Input frequency ····· 50 or 60 Hertz
Max. trimpot speed range ····· 60% to 110% of base speed
Min. trimpot speed range ····· 0% to 30% of maximum speed
Power devices ····· isolated case tab
Shunt field voltage ····· 100VDC for 120VAC input; 200VDC for 240VAC input; 1 amp maximum
Speed control ····· via 5Kohms potentiometer or 0-10VDC isolated signal
Speed range ····· 50:1
Speed regulation ····· ±1% of base speed
Temperature range ····· -10º to 45º C. ambient (15º to 115º F.)
Transient protection ····· G-Mov
Trigger ····· opto-coupler
Type ramp of accel/decel ····· RC time constant (standard) Linear (optional)
Enclosure type ····· Nema 1

125D CONTROL SERIES

DART CONTROLS

Instruction Manual

Variable Speed Control



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5000 W. 106th Street
Zionsville, Indiana 46077

Phone (317) 873-5211
Fax (317) 873-1105
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WARRANTY

Dart Controls, Inc. (DCI) warrants its products to be free from defects in material and workmanship. The exclusive remedy for this warranty is DCI factory replacement of any part or parts of such product which shall within 12 months after delivery to the purchaser be returned to DCI factory with all transportation charges prepaid and which DCI determines to its satisfaction to be defective. This warranty shall not extend to defects in assembly by other than DCI or to any article which has been repaired or altered by other than DCI or to any article which DCI determines has been subjected to improper use. DCI assumes no responsibility for the design characteristics of any unit or its operation in any circuit or assembly. This warranty is in lieu of all other warranties, express or implied; all other liabilities or obligations on the part of DCI, including consequential damages, are hereby expressly excluded.

NOTE: Carefully check the control for shipping damage. Report any damage to the carrier immediately. Do not attempt to operate the drive if visible damage is evident to either the circuit or to the electronic components.

All information contained in this manual is intended to be correct, however information and data in this manual are subject to change without notice. DCI makes no warranty of any kind with regard to this information or data. Further, DCI is not responsible for any omissions or errors or consequential damage caused by the user of the product. DCI reserves the right to make manufacturing changes which may not be included in this manual.

WARNING

Improper installation or operation of this control may cause injury to personnel or control failure. The control must be installed in accordance with local, state, and national safety codes. Make certain that the power supply is disconnected before attempting to service or remove any components!!! If the power disconnect point is out of sight, lock it in disconnected position and tag to prevent unexpected application of power. Only a qualified electrician or service personnel should perform any electrical troubleshooting or maintenance. At no time should circuit continuity be checked by shorting terminals with a screwdriver or other metal device.

INTRODUCTION

- **The 123D variable speed control is available in a range of 150mA through 5.5 ADC (or up to 10 ADC if using a suitable external heatsink) at 24 through 36 VAC input.**
- **The 125D variable speed control is available in a range of 150mA through 1/4 H.P. at 120/240 VAC input.**
- **The 125DV variable speed control is available in a range of 1/8 through 1 H.P. at 120/240 VAC input. With -HS(125D) *or* suitable external heatsink (where 125D extrusion temperature does not exceed 70° C.), maximum U.L./C.S.A. rating can be increased to 2 H.P. and 10 Amps DC.**
- **The control is designed for DC Permanent Magnet, Shunt Wound, and some Universal (AC/DC) motors in the above horsepower ranges.**
- **Incoming AC voltage is converted to adjustable full wave rectified DC voltage to operate the DC motor. Also, a full wave field voltage is provided for shunt wound motors (see page 11 for voltages).**
- **The control incorporates transient voltage protection with adjustable current limit which fits into a compact package. It features adjustable minimum and maximum speeds along with adjustable IR compensation and an inhibit function.**
- **Options are available to change ACCEL/DECEL time (see page 8, -15 / -K options).**
- **U.L. Recognized under Standard 508, U.L. File # E78180.**

CONTROL FEATURES

MINIMUM SPEED - Allows adjustment of the motor speed when the speedpot is set at minimum (CCW). This permits the user to eliminate "Deadband" on the main speed control, permitting zero calibration. Clockwise rotation of "MIN" trimpot increases speed.

MAX SPEED (Maximum Speed) - Allows adjustment of the motor speed when the speedpot is set at maximum (CW). This permits the user to eliminate the top end "Deadband", which will provide full speed at maximum rotation. Rotation of the "MAX" trimpot in the clockwise direction increases the maximum motor speed.

I.R. COMP (Speed Regulation) - This allows for adjustment of the circuitry that controls the speed regulation of the motor. The circuitry controls armature speed by changing the armature voltage to compensate for increased or decreased motor loading. Clockwise rotation of the "IR COMP" trimpot will increase compensation.

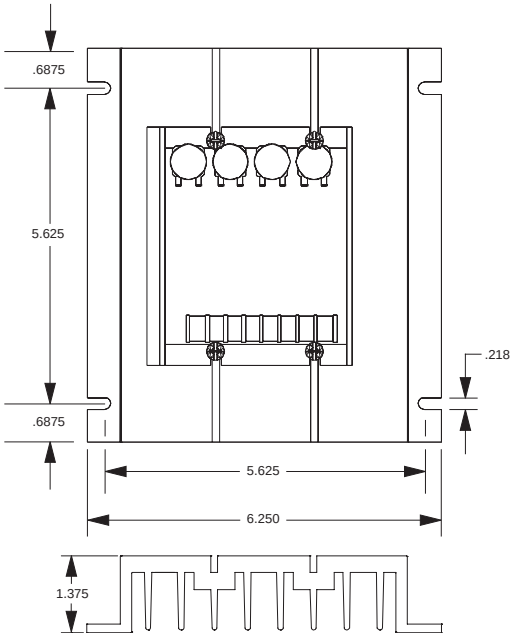
CUR. LIM. (Current Limit) - Provides protection from excessive armature current by limiting the maximum armature current the control can provide. This enables adjustment of the maximum torque the motor can deliver. Torque adjustment (Cur. Lim.) is preset at 125% of rated motor torque (current) based on horsepower. Clockwise rotation of the "CUR. LIM." trimpot increases the torque (current) the control will provide.

INHIBIT TERMINAL PIN - Allows the user a choice of stopping and starting hard (fast) or stopping hard with a soft start through an adjustable acceleration ramp, without breaking the AC lines (see page 6).

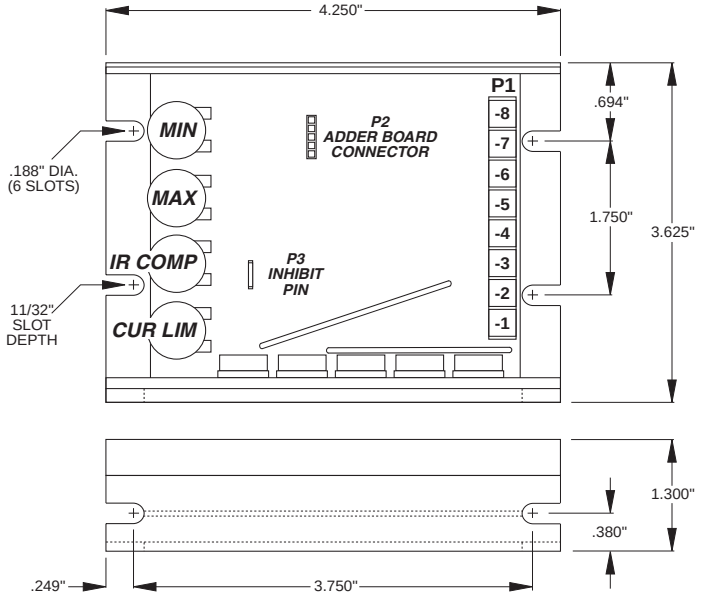
TERMINAL STRIP - Allows for connection of AC lines, motor leads, motor field (if needed), and speed potentiometer

125D SERIES HEATSINK DIMENSIONS

AUXILIARY HEATSINK -HS(125D)



STANDARD HEATSINK



MOUNTING PROCEDURE

1. Six 3/16" wide slots are provided for control mounting.
2. Control chassis can be used as a template.
3. Use standard hardware to mount.

CAUTION:
DO NOT MOUNT WHERE AMBIENT TEMPERATURE IS OUTSIDE THE RANGE OF -10° C (15° F) TO 45° C (115° F)

MODEL SELECTION

HORSEPOWER	INPUT VOLTAGE	OUTPUT VOLTAGE	OUTPUT* AMPS DC	MODEL NUMBER
150mA thru 5.5 A	24 to 36 VAC	0-20 / 0-30 VDC	5.5A	123D-C
1/50 thru 1/8	120/240 VAC	0-90 / 0-180 VDC	1.2A	125D-12C
1/8 thru 1	120/240 VAC	0-90 / 0-180 VDC	5.5A	125DV-C

NOTE: * With -HS(125D) *or* suitable external heatsink (where 125D extrusion temperature does not exceed 70° C.), maximum U.L. and C.S.A. rating for Output Amps can be increased to 10 Amps D.C.

WIRING PROCEDURE & FUSING

1. Size all wires which carry armature or line currents **AS SPECIFIED BY NATIONAL, STATE, AND/OR LOCAL CODES.** All other wires may be # 18 AWG or smaller as permitted by local code.
2. **Separate control wires** from the armature and AC lines when routed in conduit or in wire trays.
3. **Fusing** - The motor and control are protected against overloads by the current limit circuit and a customer installed fuse in the AC line. **THIS PROTECTION ALREADY MAY BE PROVIDED BY THE CUSTOMER WITH CIRCUIT BREAKERS OR FUSES IN BOTH MAIN LINES. IF NOT:**

   FOR 120 VAC INPUT - fuse protection should be added by the customer in AC Line 1 (see following chart)

   FOR 240 VAC INPUT - fuse protection should be added by the customer in AC Line 1 and Line 2 (see following chart)

FUSING ADDED BY CUSTOMER (Bussman ABC or Little Fuse 314 Series ceramic fuses)

HORSEPOWER	120 VAC INPUT	240 VAC INPUT
1/50	2 AMP	---------
1/20	2 AMP	1 AMP
1/8	3 AMP	2 AMP
1/4	4 AMP	3 AMP
1/3	6 AMP	3 AMP
1/2	8 AMP	4 AMP
3/4	12 AMP	6 AMP
1.0	15 AMP	8 AMP
1.5	----------	12 AMP
2.0	----------	15 AMP

NOTE: To determine fusing for the 123D-C Series control (24 to 36 VAC input), use 200% of Full Load Current.

TERMINAL STRIP WIRING INSTRUCTIONS

The 125D Series uses an 8 position terminal strip for ease of connection.

P1-1,2 ***(AC or L)*** ***(AC or N)*** **120 VAC - Connect incoming hot AC or L (black wire) to P1-1 and neutral AC or N (white wire) to P1-2. Connect ground (green wire) to CHASSIS of control.**

240 VAC - Connect both hot sides (L & N), one to P1-1 and one to P1-2. Connect ground wire to CHASSIS of control.

P1-3 ***(+Arm)*** **Connect to PLUS (+) Armature wire on motor. 0-90 VDC for 120 VAC input <u>or</u> 0-180 VDC for 240 VAC input. See "SPECIFICATIONS" for output rating.**

P1-4 ***(-Arm/-Field)*** **Connects to MINUS (-) Armature wire on motor and, if necessary, connect MINUS (-) Field wire of SHUNT WOUND MOTOR.**

(continued of following page)

(continued)

P1-5 ***(+Field)*** **DO NOT use for Permanent Magnet Motor. This supplies +Field voltage for a SHUNT WOUND MOTOR (refer to field voltage table). For motors with dual voltage field (ie. 50/100V or 100/200V), make sure highest value is connected.**

FIELD VOLTAGE TABLE				
VAC INPUT	24	36	120	240
VDC FIELD	20	30	100	200

P1-6 ***(Speedpot Hi)*** **Connects to high side (white wire) of Speedpot (CW end). This is internal +12 volts. For start-stop applications, the connection between this terminal and Speedpot HI can be opened and closed by a SPST switch. INPUT MUST NOT BE GROUNDED!**

P1-7 ***(Speedpot Wiper)*** **Connects to wiper (red wire) of Speedpot (center lead). For Voltage Follower applications, this INPUT MUST NOT BE GREATER THAN +12V MAXIMUM AND MUST NOT BE GROUNDED!**

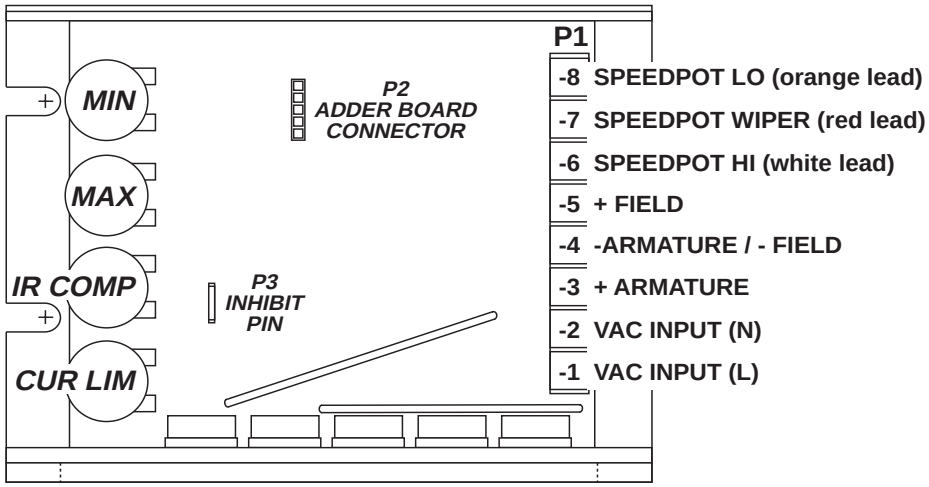
P1-8 ***(Speedpot Lo)*** **Connects to Low side (orange wire) of 5K Speedpot (CCW end). This input is raised and lowered by the MIN. trimpot (5K). Electronic speed input (voltage follower) may be referenced to Speedpot LO if the MIN trimpot adjustments are to be active. Otherwise, inputs may be referenced to -ARM, which will bypass the MIN trimpot. INPUT MUST NOT BE GROUNDED!**

Warning:

1. **Be sure the control housing is properly grounded.**
2. **Armature connections must not be switched or broken while the control is on. Serious control damage may result.**
3. **For non-speedpot applications, the input connection to the LO, WIPER, and HI terminals must not be grounded! Serious control damage may result from a grounded input.**

123D/125D HOOK-UP DIAGRAM

Warning:
Do not attempt to perform Hi-pot test across AC lines with control in circuit. This will result in immediate or long term damage to the control.



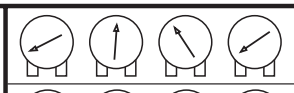
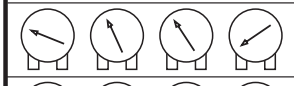
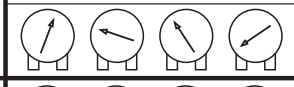
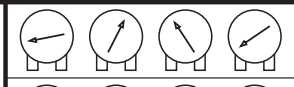
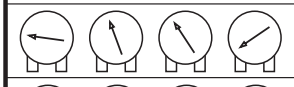
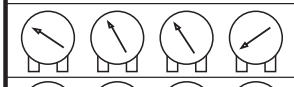
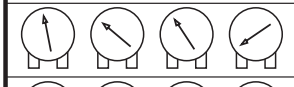
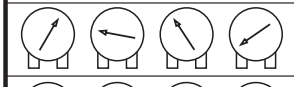
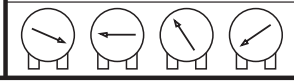
CONTROL START-UP

WARNING: ALL POWER MUST BE TURNED OFF BEFORE PROCEEDING!

1. Recheck all wiring. Accidental grounds, loose or pinched wires on armature or speedpot wires may damage the control when power is applied.
2. Check to see that incoming service is of correct voltage.
3. Turn speedpot to zero (fully CCW).
4. Turn power on, and advance speedpot while observing motor. **Power must be off before step 5 can be accomplished!**
5. If motor rotation is incorrect, turn power off at external disconnect and reverse +ARM and -ARM connections.
6. Check for satisfactory operation throughout the speed range.
7. If operation is satisfactory, no readjustments are needed.
8. If instability or surging is observed, or if maximum speed is higher than desired, see "TRIMPOT ADJUSTMENT CHART " on page 5.
9. For other problems, consult page 10, “IN CASE OF DIFFICULTY”.

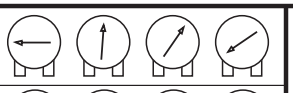
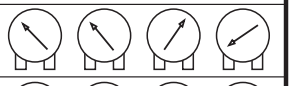
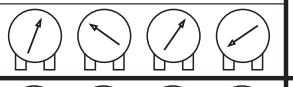
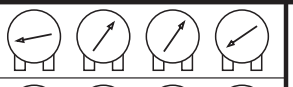
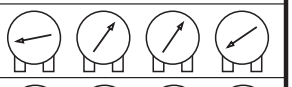
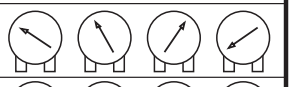
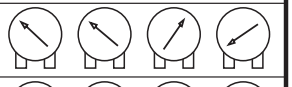
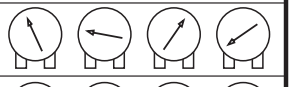
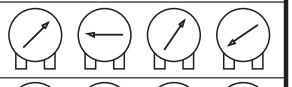
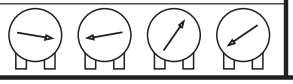
TRIMPOT ADJUSTMENT CHART & PROCEDURE

Settings apply when using a 5K ohm master speedpot. This chart is used in conjunction with the adjustment procedure and is approximate.

	C.L.	I.R.	MAX	MIN	HP
125D-12C 120 VAC input; 0-90 VDC output					**1/50**
					**1/20**
					**1/8**
125DV-C 120 VAC input; 0-90 VDC output					**1/8**
					**1/4**
					**1/3**
					**1/2**
					**3/4***
					**1.0***

Operation of the control beyond ±10% of the normal line voltage could result in re-adjustment. These adjustments are permanent; periodic re-adjustment is normally not needed.

Settings apply when using a 5K ohm master speedpot. This chart is used in conjunction with the adjustment procedure and is approximate.

HP	C.L.	I.R.	MAX	MIN	
1/20					**125D-12C** 240 VAC input; 0-180 VDC output
1/8					
1/4					
1/4					**125DV-C** 240 VAC input; 0-180 VDC output
1/3					
1/2					
3/4*					
1.0*					
1.5*					
2.0*					

*** NOTE: ADDITIONAL CUSTOMER HEATSINK REQUIRED FOR 125DV-C (120 VAC INPUT - GREATER THAN 1/2 H.P. MOTORS) AND (240 VAC INPUT - GREATER THAN 1 H.P. MOTORS). 125 EXTRUSION TEMPERATURES SHOULD NOT EXCEED 70 DEGREES C.**

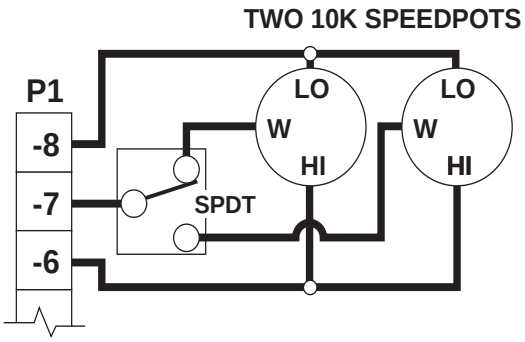
NOTE: FOR DETERMINING TRIMPOT SETTINGS FOR THE 123D-C SERIES, SEE TRIMPOT SETTINGS PROCEDURE BELOW.

TRIMPOT	FUNCTION	ADJUSTMENT
MIN.	Sets minimum motor speed when speedpot is set at zero. CW rotation will increase minimum motor speed.	1. Set Speedpot to zero (fully CCW). 2. Rotate MIN trimpot CW until motor starts to rotate. 3. Slowly rotate MIN trimpot CCW until motor stops. NOTE: If motor rotation is desired, rotate MIN trimpot CW until desired MIN speed is reached.
IR COMP	Provides a means of improving motor speed regulation in the armature feedback mode. If a slowdown due to load change is of no concern, rotate this trimpot fully CCW.	1. Set Speedpot at 50%. 2. Observe motor speed at no load condition. 3. Apply full load to motor. 4. Turn IR COMP trimpot CW to obtain the same motor speed as with no load.
MAX.	Sets maximum motor speed when speedpot is set at maximum (fully CW rotation). CW rotation of MAX trimpot increases maximum motor speed.	1. TURN DRIVE POWER OFF!! 2. Connect a DC Voltmeter: + to +ARM, - to -ARM. **NOTE: Meter must not be grounded!!** 3. Set meter voltage range: (90 VDC for 120 VAC, 180 VDC for 240 VAC). 4. Turn power on. Set Speedpot at 100%. 5. Adjust MAX trimpot to rated motor armature voltage as shown on meter. NOTE: A tachometer or strobe may be used in lieu of a meter. Follow above steps, except adjust MAX trimpot to rated motor base speed indicated by tachometer or strobe.
CUR.LIM.	Limits DC motor armature current (torque) to prevent damage to the motor or control. The current limit is set for the rated motor current. CW rotation of this trimpot increases the armature current (or torque produced).	1. TURN DRIVE POWER OFF! 2. Connect a DC Ammeter between A1 on motor and +ARM on control. This is in series with the motor. 3. Turn power on. 4. Set Speedpot at the 50% position. 5. Apply friction braking to motor shaft until motor stalls. 6. With motor stalled, set current at 125% of rated motor armature current by adjusting CUR. LIM . trimpot.

CONTROL MODIFICATIONS

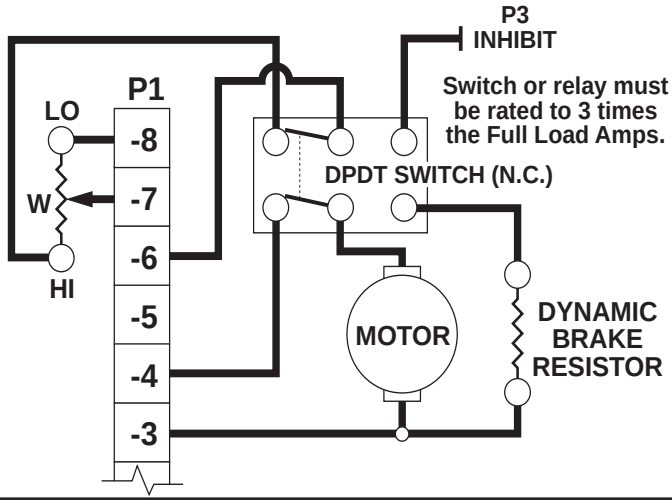
TWO SPEED OPERATION

Two pot operation is done using two 10K ohm speed potentiometers in parallel (both HI's to P1-6, both LO's to P1-8). The WIPER is switched using a SPDT switch.



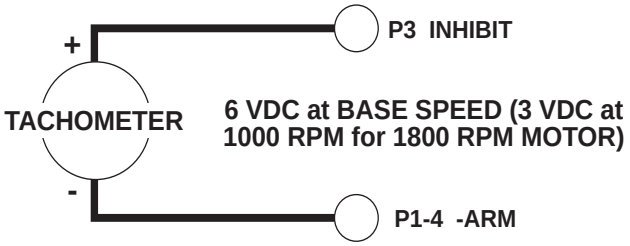
DYNAMIC BRAKING

A DPDT switch is used to inhibit the control and to connect the DBR. Typical values for the DBR (dynamic brake resistor) are 5 ohms for 120V, 10 ohms for 240V (both 35W to 50W). Note that motor horsepower, inertia, and cycle time effect sizing of the DBR. NOTE: This modification cannot be used with any of the -15 options.



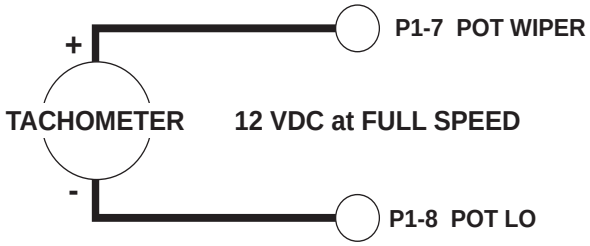
TACHOMETER FEEDBACK

Improves speed regulation to ±1/2% of base speed.



TACHOMETER FOLLOWER

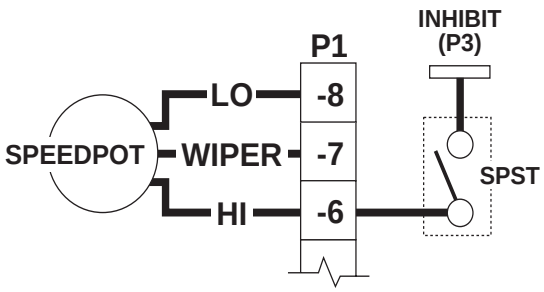
Allows control output to follow tachometer voltage.



NOTE: NEED 1% OR LESS - TACH OUTPUT RIPPLE

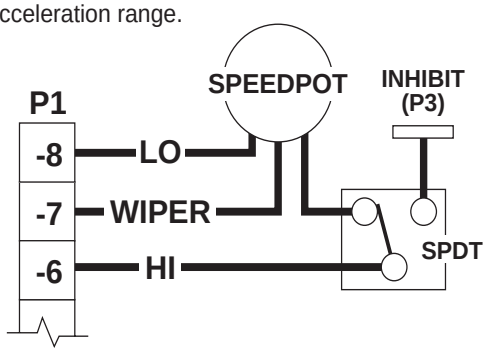
INHIBIT (USED INDEPENDENTLY)

The customer supplied SPST switch is connected in series between the speedpot HI (P1-6) and the Inhibit pin (P3). To inhibit (stop motor), speedpot HI is closed to the Inhibit pin. To restart, the switch is returned to open. NOTE: The control will stop and start fast.



INHIBIT (USED WITH SPEEDPOT)

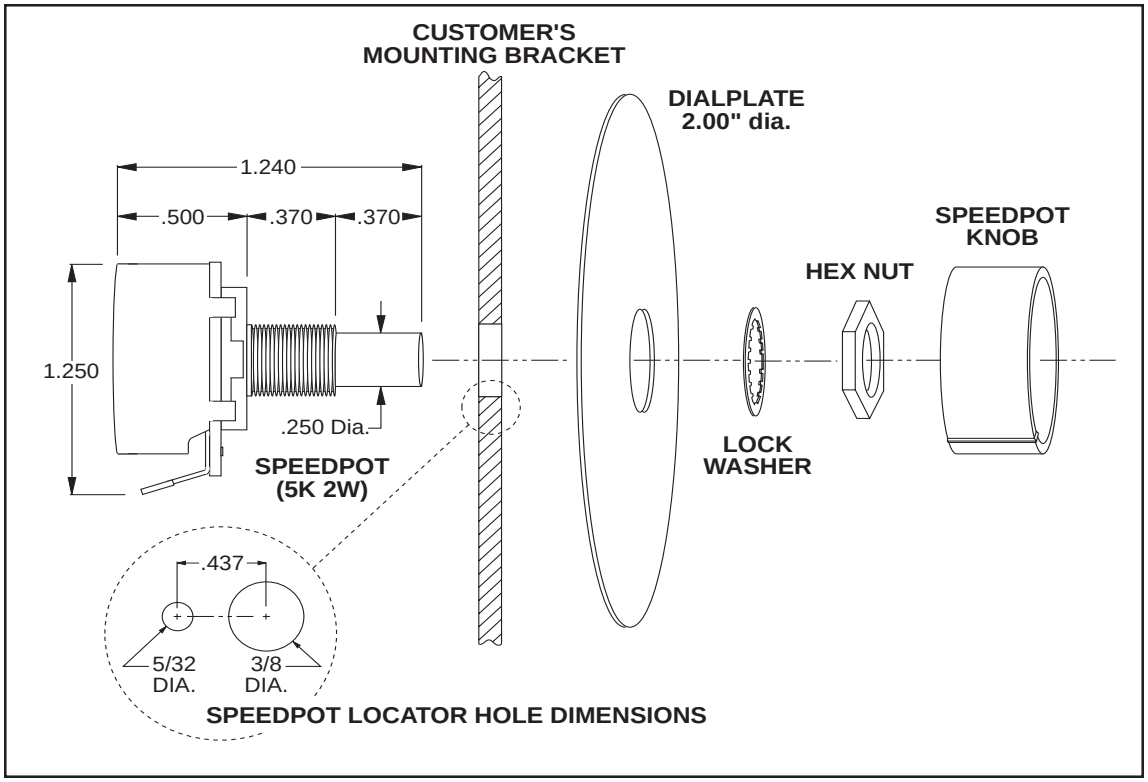
The Common of the SPDT switch is connected to control pot HI and is switched between Speedpot Hi and the Inhibit pin (P3). To inhibit (stop motor), speedpot HI is closed to the Inhibit pin. To restart, the switch is returned to Speedpot Hi. NOTE: The control will stop fast and soft start through a fixed acceleration range.



NOTE: Permits starting and stopping of motor without breaking AC lines. In the event of SCR failure or false triggering, the Inhibit circuit will not stop motor.

Always use a shielded wire when connecting to the inhibit terminal. The shield should be connected to -Armature or Common of the control.

SPEEDPOT KIT ASSEMBLY



OPTION DESCRIPTIONS

-1 option

Field or Factory Installed

Electronic Speedpot Interlock — **Available All Models**

The -1 adder board connects to the 125 series board through use of a female connector and plastic standoff support.

When incoming AC power to the control is applied, the Electronic Interlock will prevent the motor from starting until the speedpot is first rotated to the zero position and then rotated clockwise toward the set speed.

Also, should the incoming AC power be interrupted for any reason, then restored, the Electronic Interlock will prevent an automatic restart of the motor. To restart, the speedpot must first be rotated to the zero position and then rotated clockwise toward the set speed.

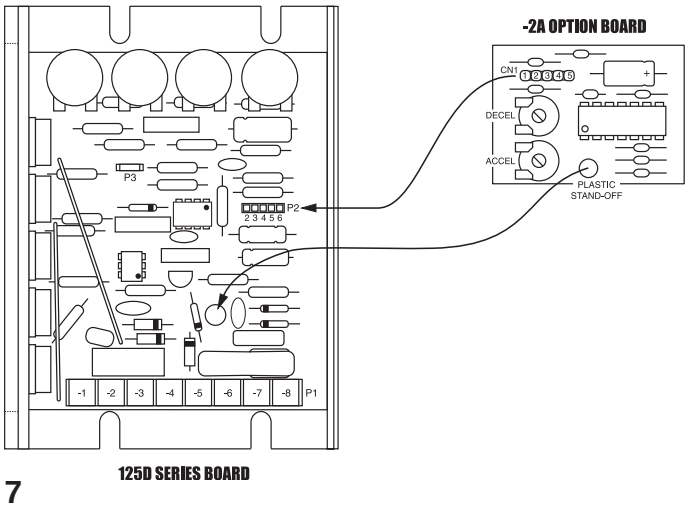
CAUTION: The Electronic Interlock becomes inoperative if SCR failure should occur.

-2A option

Field or Factory Installed

Individually Adjustable Linear Accel and Decel — **Available All Models**

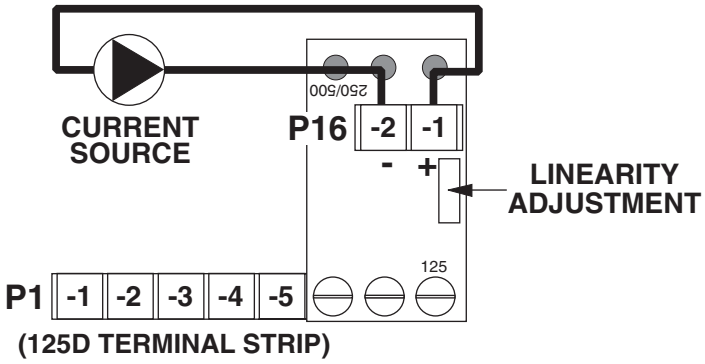
This option plugs into the five position expansion connector on the 125D main board. The -2A option overrides the fixed accel ramp built into the 125D control, providing independently adjustable linear accel and decel from 0.5 to 8.0 seconds. To install, flip over the -2A option board so the printed circuit lines are visible. Align the male connector CN1 (-2A option) with the female connector P2 (125D board) so terminal CN1-1 fits into P2-6, CN1-2 in P2-5, etc. Align the plastic stand-off on the -2A option board with the hole shown on the 125D main board. Once connectors and stand-off are aligned, snap into place. Adjustment of both trimpots is accomplished via the labeled access holes on the back side of the -2A option board. Full CCW rotation equals minimum accel or decel time and full CW rotation equals maximum accel or decel time. Note: Each trimpot operates independently of the other.



-5 option

Isolated 4-20 ma.Signal Follower — **Field or Factory Installed** / **Available All Models**

4 to 20 mA ..... -5



DO NOT USE TRIMPOT CHART TO ADJUST MIN AND MAX TRIMPOTS ON MAIN BOARD. IF ADJUSTMENT IS NEEDED THEN REFER TO THE SETUP PROCEDURE BELOW.

This option replaces the speedpot with a 4-20 ma. signal to control speed. The current signal input can be either grounded or ungrounded. The board sets on spacers screwed to terminals P1-6, P1-7, and P1-8 on the main board using long screws. The current source connects to the + and - two position terminal strip (P16-1 and -2) on the -5 option board.

The Linearity trimpot on the -5 option board is set at the factory for proper linearity, however this trimpot may need to be re-set after tuning the controls Max and Min trimpot settings for your specific application. If needed then refer to the setup procedure below.

Setting the Min, Max and Linearity Trimpots.

1. Preset the multi-turn Linearity trimpot on the –5 option board full CW, set the Min trimpot full CCW and set the Max trimpot at about 50% rotation.
2. Input a 4 ma. current signal to the control and turn the Min trimpot CW to your desired minimum output voltage or to deadband (the point just before you begin to get an output).
3. Input a 20 ma. current signal to the control and set the Max trimpot to the desired maximum speed setting.
4. With 20 ma. still going to the control, turn the Linearity trimpot CCW until your output speed starts to decrease. Then slowly turn it back CW until you just reach your maximum speed setting.

-7 option

Isolated 4-20 ma. Signal Follower with Auto / Manual Switch — **Field or Factory Installed** / **Customer Wired**

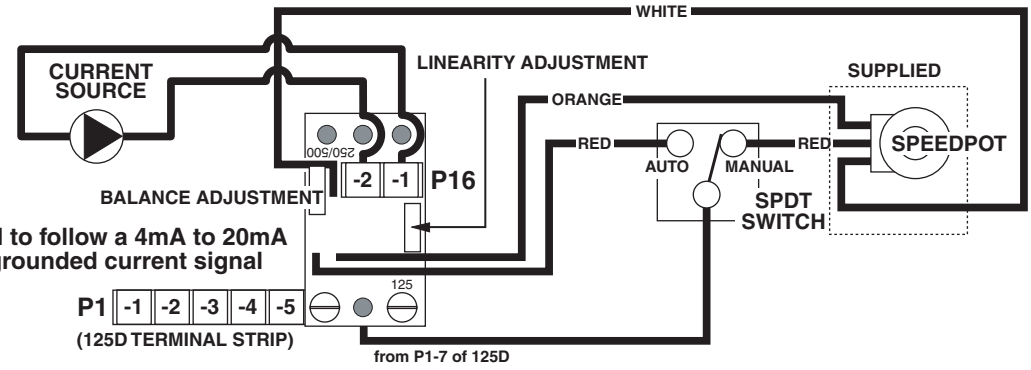
DO NOT USE TRIMPOT CHART TO ADJUST MIN AND MAX TRIMPOTS ON MAIN BOARD. IF ADJUSTMENT IS NEED THEN REFER TO THE SETUP PROCEDURE BELOW.

This option allows the control to be run in either the Manual mode via a speed pot or the Auto mode via the 4-20 ma. signal. The current signal input can be either grounded or ungrounded. The board sets on spacers screwed to terminals P1-6, P1-7, and P1-8 on the main board using long screws. The current source connects to the + and - two position terminal strip (P16-1 and -2) on the -7 option board.

This option includes a Balance trimpot which is used to scale the maximum speed in the manual mode. It is factory set so the maximum speed in manual equals the maximum speed in automatic.

The Linearity trimpot on the -7 option board is set at the factory for proper linearity, however this trimpot may need to be re-set after tuning the Max and Min trimpot settings on the control or if the Balance trimpot on the –7 must be reset for your specific application. If needed then refer to the setup procedure below.

4 to 20 mA.... -7



Setting the Min, Max, Balance and Linearity Trimpots.

1. Preset the multi-turn Linearity trimpot and the Balance trimpot on the –7 option board full CW, set the Min trimpot full CCW and set the Max trimpot at about 50% rotation.
2. Input a 4 ma. current signal to the control and turn the Min trimpot CW to your desired minimum output voltage or to deadband (the point just before you begin to get an output).
3. Input a 20 ma. current signal to the control and set the Max trimpot to the desired maximum speed setting.
4. Switch the control to the Manual mode setting and adjust the Balance trimpot CCW as needed to attain your required manual mode maximum output speed. (Adjustable form 50 to 100% of maximum Auto mode setting)
5. Switch the control back to Auto mode. With 20 ma. still going to the control, turn the Linearity trimpot CCW until your output speed starts to decrease. Then slowly turn it back CW until you just reach your maximum speed setting.

-11 option

Field Installed

10 Turn Master SpeedPot — **Available All Models**

Provides finer control of speed. Use standard Hook-up directions and Trimpot Chart (page 5).

-15B / -K options

Acceleration Time Ranges — **Factory Installed**

This option provides the Accel times shown below. The standard Accel time is 0.5 seconds.

	-15B OPTION	-K OPTION
ACCELERATION TIME	4 seconds	6 seconds

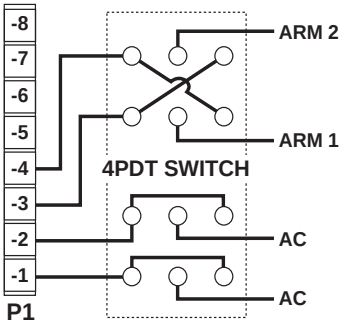
USE STANDARD HOOK-UP

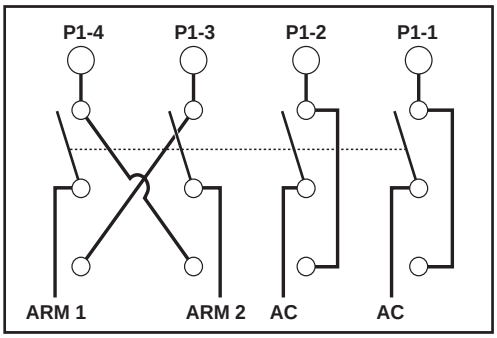
-29B option

Manual Forward-Off-Reverse Switch — **Field Installed Only**

Permits reversing of motor. This is accomplished using a 4PDT blocked center switch. When switched between the forward/reverse positions, a delay is encountered due to the blocked center position, which protects the control from any voltage that may be at the ARM terminals. The center position is OFF/NEUTRAL.

THE MOTOR MUST COME TO A COMPLETE STOP BEFORE CHANGING DIRECTIONS. IF THE MOTOR DOES NOT COME TO A COMPLETE STOP, SERIOUS DAMAGE TO THE CONTROL MAY RESULT. BYPASS OF THE SWITCH CENTER BLOCK MAY RESULT IN DAMAGE TO THE CONTROL.





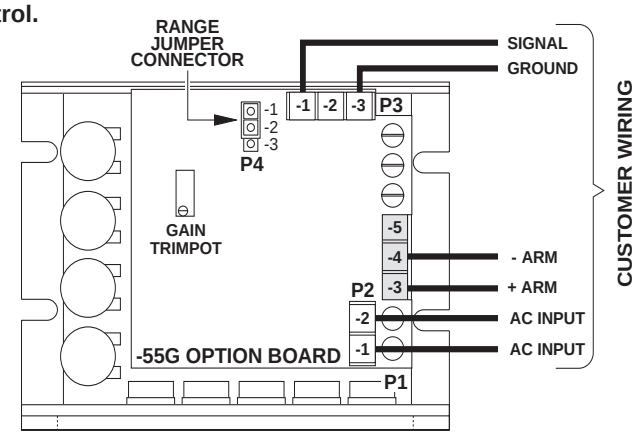
-55G option

Isolated Voltage Input — Factory or Field Installed

NOTE: This option cannot be used on the 123D-C series control.

This option permits either a grounded or non-grounded remote DC voltage speed command. This DC input can range from 0-5VDC through 0-25VDC or 0-25VDC through 0-250VDC (which can be selected via the range jumper clip and adjusted with the GAIN trimpot). The output of this option board supplies a linear pulse width modulated signal to the control that is proprotional to the input signal supplied to the option board. The option replaces the 5K speedpot. Input impedance is 1.2M ohms on high scale, and 150K ohms on low scale.

NOTE: Range jumper connector is used to select input voltage range. When installed from P4-1 to P4-2, the range is 0-25VDC through 0-250VDC; when installed from P4-2 to P4-3, range is 0-5VDC through 0-25VDC.



(FOR SHUNT WOUND MOTOR, SEE PAGE 4 OF MANUAL FOR FIELD CONNECTIONS).

CAUTION: DO NOT use TRIMPOT ADJUSTMENT CHART. Set pots using directions in following SET-UP PROCEDURES.

SETUP PROCEDURE FOR -55G AND -56G OPTIONS

1. With **NO** power to control, connect a DC Voltmeter (meter must not be grounded) to control outputs as follows: Meter COMMON to the -ARM terminal, Meter POSITIVE to the +ARM terminal. Select correct meter range (0-90V or 0-180V).
2. Preset GAIN trimpot on option board fully CCW, place range jumper clip in proper position.
3. Preset control as follows: MIN, MAX & IR fully CCW, and Current Limit fully CW.
4. Apply AC power of correct voltage to control and option board.
5. With 0 volts into option board, adjust MIN trimpot of control to eliminate deadband. To do this, increase MIN fully CW, then adjust CCW until meter reads 0 volts.
6. Apply maximum input voltage to option board input. Motor will start to rotate.
7. Adjust GAIN until no further change in control output voltage occurs, back off approximately 1 turn, then set control MAX. setting to 90 VDC (180VDC for 240V units).
8. Current Limit is set as shown on "TRIMPOT ADJUSTMENT CHART" on page 5.
9. For Closed Looped systems the IR should remain fully CCW. For Open Looped systems, set IR as needed

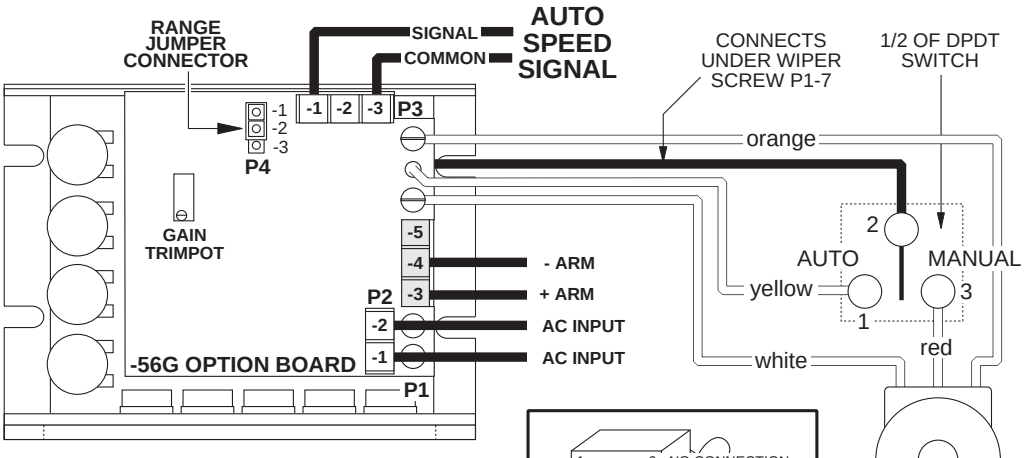
-56G option

Isolated Voltage Input with Auto / Manual Switch — Factory or Field Installed

NOTE: This option cannot be used on the 123D-C series control.

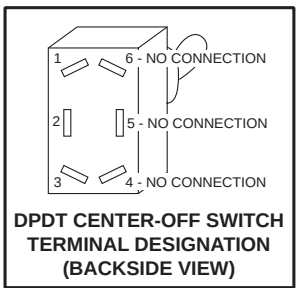
This option permits either a grounded or non-grounded remote DC voltage speed command. This DC input can range from 0-5VDC through 0-25VDC or 0-25VDC through 0-250VDC (which can be selected via the range jumper clip and adjusted with the GAIN trimpot). The output of this option board supplies a linear pulse width modulated signal to the control that is proprotional to the input signal supplied to the option board. The option replaces the 5K speedpot. Input impedance is 1.2M ohms on high scale, and 150K ohms on low scale.

(FOR SHUNT WOUND MOTOR, SEE PAGE 4 OF MANUAL FOR FIELD CONNECTIONS).



NOTE:
Range jumper connector is used to select input voltage range. When installed from P4-1 to P4-2, the range is 0-25VDC through 0-250VDC; when installed from P4-2 to P4-3, range is 0-5VDC through 0-25VDC.

= CUSTOMER WIRING
= FACTORY WIRING



DPDT CENTER-OFF SWITCH TERMINAL DESIGNATION (BACKSIDE VIEW)

CAUTION: DO NOT use TRIMPOT ADJUSTMENT CHART. Set pots using directions in following SET-UP PROCEDURES.

IN CASE OF DIFFICULTY

PROBLEM	POSSIBLE CAUSE(S)	CORRECTIVE ACTION(S)
Motor doesn't operate	**- Blown Fuse**	**Replace Fuse**
	- Incorrect or no power source	**Install proper service**
	- Speedpot set at Zero	**Adjust Speedpot CW to start**
	- Worn motor brushes	**Replace brushes**
Armature output voltage cannot be adjusted, output is a constant DC level	**- No motor or load connected**	**Check that motor or load is connected to armature terminals**
	- Speedpot low connection open	**Check that speedpot low wire is connected**
Motor stalls, or runs very slowly with speed control turned fully CW	**- Low Voltage**	**Check-should be above 100V or 208 V**
	- Overload Condition	**Reduce load**
	- Worn motor brushes	**Replace brushes**
	- MAX SPEED set incorrectly	**See ADJUSTMENT PROCEDURE**
Motor hunts	**- Motor current less than 150mA**	**Motor current must be greater than 150mA D.C.**
	- Too much IR COMP	**See ADJUSTMENT PROCEDURE**
	- Motor is in current limit	**See ADJUSTMENT PROCEDURE**
	- Motor speed is above rated speed	**Reduce Speed**
	- Max set too high	**See ADJUSTMENT PROCEDURE**
Repeated fuse blowing	**- Low Voltage**	**Check-should be above 100V or 208V**
	- Overload Condition	**Reduce load**
	- Worn motor brushes	**Replace**
	- Defective motor bearings	**Replace**
	- Defective electrical components	**Call Dart Distributor or Representative**

If control still will not operate, consult your Dart Distributor or Representative.

SPECIFICATIONS

AC input voltage ..... ±10% of rated line voltage
Acceleration ..... 0.5 seconds (standard 125D)
Amps - DC output ..... 150 mA to 5.5 ADC*
Controller overload capacity ..... 200% for one minute
Current limit trimpot range ..... 0.3 to 2.5 ADC (125D); 1 to 15 ADC (123D & 125DV)
Deceleration ..... 0.5 seconds (standard 125D)
Dimensions and weights:

	WIDTH	LENGTH	DEPTH	WEIGHT
ENGLISH	3.625"	4.250"	1.300"	8.00 oz.
METRIC	92mm	108mm	33mm	228 gms.

Drive service factor 1.0
Efficiency ..... 85% typical
Input frequency ..... 50 or 60 Hertz
Max. trimpot speed range ..... 60% to 110% of base speed
Min. trimpot speed range ..... 0% to 30% of maximum speed
Power devices ..... isolated case tab
Shunt field voltage ..... 20VDC for 24VAC input; 30VDC for 36VAC input; 100VDC for 120VAC input; 200VDC for 240VAC input; 1 amp maximum
Speed control ..... via 5Kohms 2W potentiometer or 0-10VDC isolated signal
Speed range 50:1
Speed regulation ..... ±1% of base speed
Temperature range ..... -10° to 45° C. ambient (15° to 115° F.)
Transient protection ..... G-Mov**
Trigger ..... opto-coupler
Type ramp of accel/decel ..... RC time constant

* With -HS(125D) *or* suitable external heatsink (where 125D extrusion temperature does not exceed 70° C.), maximum U.L. rating for output amps can be increased to 10 amps D.C.

** not used on the 123D-C series control

TYPICAL MOTOR CURRENTS

Horsepower	1/50	1/20	1/8	1/4	1/3	1/2	3/4	1.0	1.5	2.0
Typical AC Amps (120VAC)	0.50	1.00	2.00	3.50	4.40	6.50	9.30	13.20	-----	-----
Typical Arm Amps (120VAC)	0.42	0.81	1.60	2.70	3.40	5.00	8.20	10.90	-----	-----
Typical AC Amps (240VAC)	-----	0.80	1.20	1.80	2.20	3.30	4.80	6.50	9.70	12.90
Typical Arm Amps (240VAC)	-----	0.40	0.60	1.40	1.70	2.50	3.70	5.00	8.20	11.60

125D SERIES PARTS PLACEMENT & LIST

RESISTORS

R1	15K 6W
R2	470 Ω
R3	2.7K
R4	2.7K
R5	82K
R6	5K (MIN TRIM)
R7	300K
R8	180K
R9	1.2M
R10	39K
R11	100K
R12	10K
R13	2.2K
R14	820 Ω
R15	4.7K
R16	470K
R17	1K
R18	100 Ω (I.R. TRIM)
R19	5K (C.L. TRIM)
R20	300K
R21	10K (MAX TRIM)
R22	1K
R23	300K
R24	.01 Ω 5W
R25	91K
R26	1K
R27	390 Ω
R28	390 Ω
R29	5K SPEEDPOT *

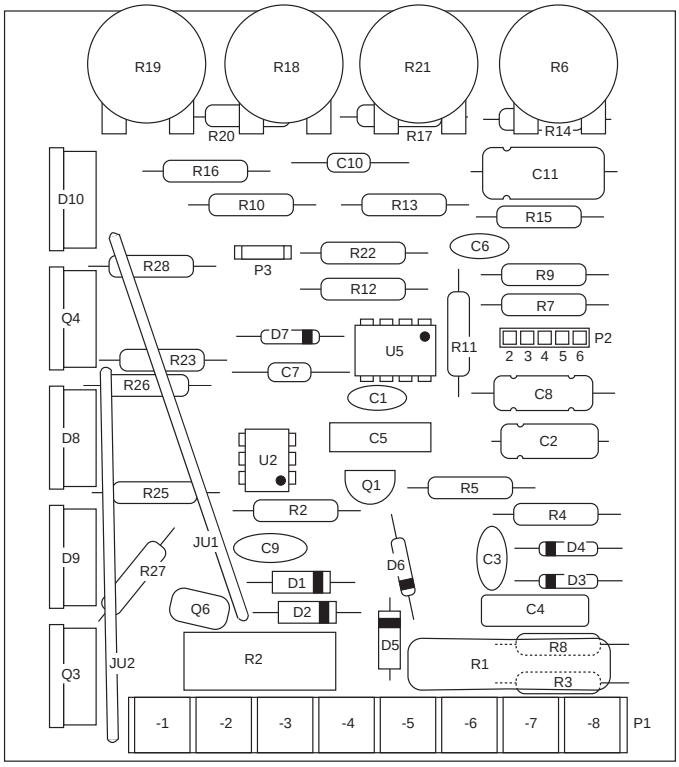
ACCEL CHANGES

Replace N.P. cap with polarized cap (see above)

-15A ... C8 ... 33uf 16V
-15B ... C8 ... 15uf 25V
-15C ... C8 ... 4.7uf 16V
- K ..... C8 ... 22uf 16V

125D-12C (1/50 thru 1/8 H.P.) CHANGES:

R24 ..... .062 Ω 5W



MISCELLANEOUS

JU1	18GA. SOLID INSULATED WIRE
JU2	18GA. SOLID INSULATED WIRE
PCB	A-4-2033F PRINTED CIRCUIT
P1 (-1 THRU -8)	8 POS. TERMINAL STRIP
P2 (-2 THRU -6)	5 POS. FEMALE CONNECTOR
P3	3/16" MALE SPADE PIN

ACTIVE DEVICES

Q1	2N6027
U2	3052 MOC
Q3	S4015L
Q4	S4015L
U5	LM358 IC
Q6	275V G-MOV

CAPACITORS

C1	.01µF 100V
C2	10µF 35V
C3	.01µF 100V
C4	.033µF 400V
C5	.22µF 1KV
C6	.001µF 1KV
C7	.1µF 50V
C8	1µF 50V N.P.
C9	.0047µF 1KV
C10	.1µF 50V
C11	47µF 16V

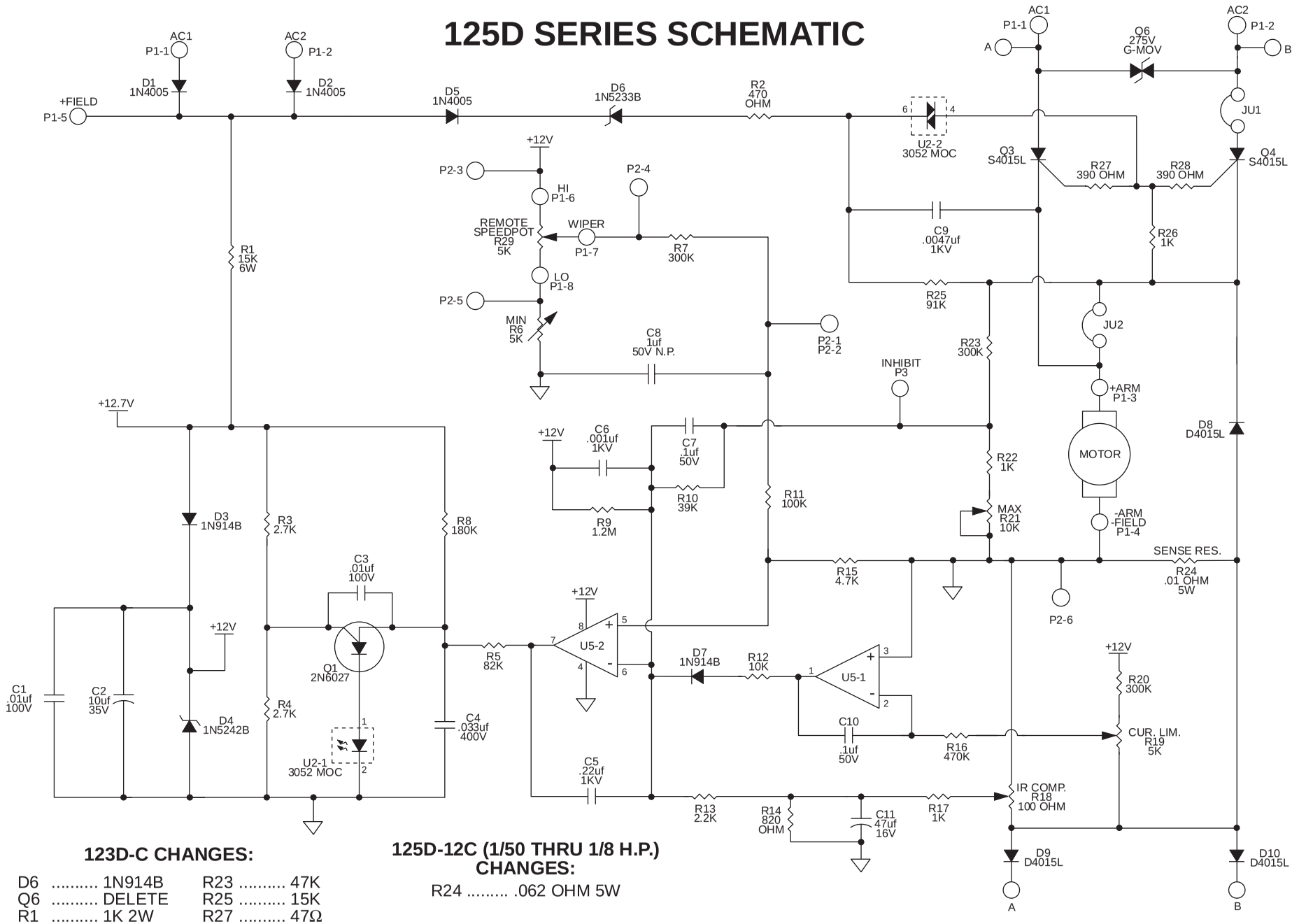
DIODES

D1	1N4005
D2	1N4005
D3	1N914B
D4	1N5242B
D5	1N4005
D6	1N5233B
D7	1N914B
D8	D4015L
D9	D4015L
D10	D4015L

123D-C CHANGES:

D6	1N914B (reverse direction)
Q6	DELETE
R1	1K 2W
R2	47Ω
R16	220K
R23	47K
R25	15K
R27	47Ω
R28	47Ω

125D SERIES SCHEMATIC



123D-C CHANGES:

D6 ..... 1N914B	R23 ..... 47K
Q6 ..... DELETE	R25 ..... 15K
R1 ..... 1K 2W	R27 ..... 47Ω
R2 ..... 47Ω	R28 ..... 47Ω
R16 ..... 220K	

125D-12C (1/50 THRU 1/8 H.P.) CHANGES:

R24 ..... .062 OHM 5W

NOTES:

U5 ..... LM358 IC

REPAIR PROCEDURE

In the event that a Product manufactured by Dart Controls Incorporated (DCI) is in need of repair service, it should be shipped, freight paid, to: Dart Controls, Inc., 5000 W. 106th Street, Zionsville, IN. 46077, ATTN: Repair Department.

Please include with each order a P.O. number to cover any repair charges (a P.O. is needed even on warranty returns to cover misuse or other failures that have voided warranty), and include a note with a brief description of the problem experienced. NO WORK WILL BE DONE ON ANY ORDER WITHOUT A P.O. NUMBER.

Completed repairs are returned with a Repair Report that states the problem with the control and the possible cause. Repair orders are returned via UPS Ground unless other arrangements are made. If you have further questions regarding repair procedures, contact your Dart Distributor or Representative.

YOUR MOTION SYSTEMS SOLUTION PROVIDER

125D SERIES
AC INPUT - VARIABLE DC OUTPUT
1/50 HP through 1.0 HP

250G SERIES
AC INPUT - VARIABLE DC OUTPUT
1/50 HP through 2.0 HP

65 SERIES
DC INPUT - VARIABLE DC OUTPUT
CURRENT RATINGS OF 20, 40, AND 60 AMPS

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DC BRUSHLESS
5 & 20 Amp for
12,24,& 36VDC Inputs

MDP SERIES
PROGRAMMABLE
CLOSED LOOP DC
SPEED CONTROL

DM SERIES
FIELD PROGRAMMABLE
DIGITAL TACHOMETER

Dart Controls, Inc. is a designer, manufacturer, and marketer of analog and digital electronic variable speed drives, controls, and accessories for AC, DC, and DC brushless motor applications.

Shown above is just a sampling of the expanded line of Dart controls that feature the latest in electronic technology and engineering. Products are manufactured in the U.S.A. at our Zionsville (Indianapolis, Indiana) production and headquarters facility - with over 2,000,000 variable speed units in the field.

In addition to the standard off-the-shelf products, you can select from a wide variety of options to customize controls for your specific application. For further information and application assistance, contact your local Dart sales representative, stocking distributor, or Dart Controls, Inc.

Dart Controls, Inc.

Manufacturer of high quality DC and AC motor speed controls and accessories since 1963.

P.O. Box 10
5000 W. 106th Street
Zionsville, Indiana 46077
Phone: (317) 733-2133
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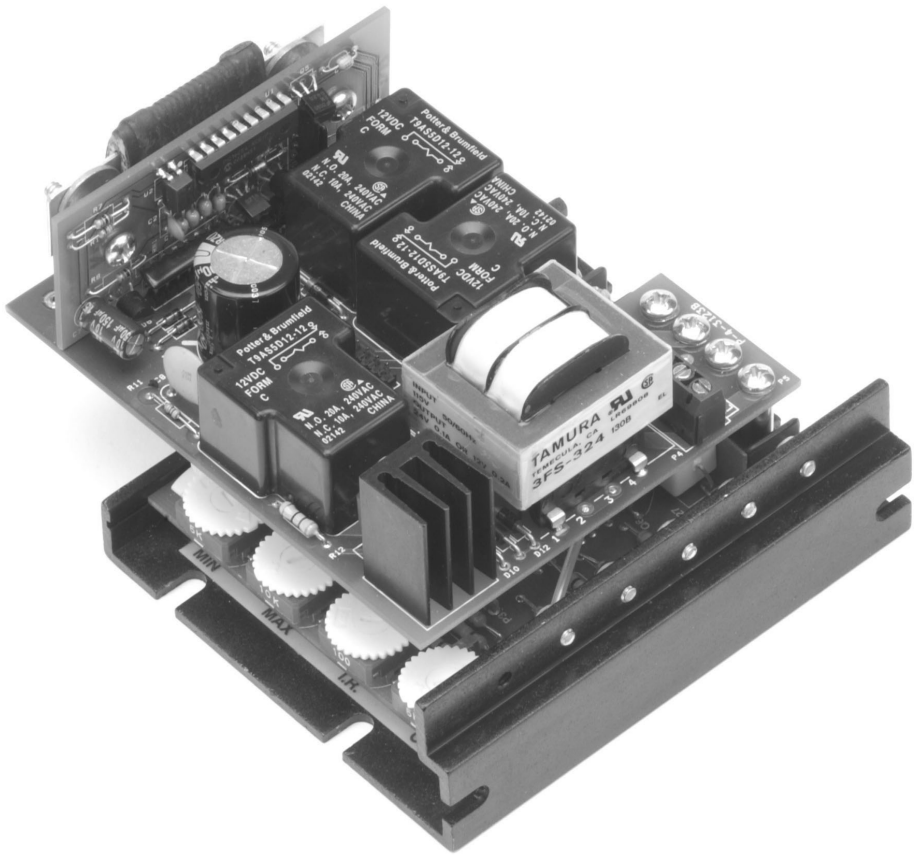
www.dartcontrols.com
ISO9001 REGISTERED

130 CONTROL SERIES

DART CONTROLS

Instruction Manual

Cycling and Reversing Variable Speed DC Control with on Board Dynamic Braking



P.O. Box 10
5000 W. 106th Street
Zionsville, Indiana 46077

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Quick Jump

What models and options are available?
See page 4.

Looking for detailed specifications?
See page 11.

Want to get started fast?
See basic electrical hook-up details on page 6.
See mechanical installation details on page 3.

Need Help?
See troubleshooting on page 10.

Warranty

Dart Controls, Inc. (DCI) warrants its products to be free from defects in material and workmanship. The exclusive remedy for this warranty is DCI factory replacement of any part or parts of such product which shall within 12 months after delivery to the purchaser be returned to DCI factory with all transportation charges prepaid and which DCI determines to its satisfaction to be defective. This warranty shall not extend to defects in assembly by other than DCI or to any article which has been repaired or altered by other than DCI or to any article which DCI determines has been subjected to improper use. DCI assumes no responsibility for the design characteristics of any unit or its operation in any circuit or assembly. This warranty is in lieu of all other warranties, express or implied; all other liabilities or obligations on the part of DCI, including consequential damages, are hereby expressly excluded.

NOTE: Carefully check the control for shipping damage. Report any damage to the carrier immediately. Do not attempt to operate the drive if visible damage is evident to either the circuit or to the electronic components.

All information contained in this manual is intended to be correct, however information and data in this manual are subject to change without notice. DCI makes no warranty of any kind with regard to this information or data. Further, DCI is not responsible for any omissions or errors or consequential damage caused by the user of the product. DCI reserves the right to make manufacturing changes which may not be included in this manual.

WARNING

Improper installation or operation of this control may cause injury to personnel or control failure. The control must be installed in accordance with local, state, and national safety codes. Make certain that the power supply is disconnected before attempting to service or remove any components!!! If the power disconnect point is out of sight, lock it in disconnected position and tag to prevent unexpected application of power. Only a qualified electrician or service personnel should perform any electrical troubleshooting or maintenance. At no time should circuit continuity be checked by shorting terminals with a screwdriver or other metal device.

TABLE OF CONTENTS

INTRODUCTION

- The 130 series reversing speed control is designed to provide instant reversing, quick precise stopping or rapid cycling for a wide range of DC motor applications. The 130 series controls outperform other dynamic braking and reversing controls by utilizing Dart's unique zero speed detect and solid state assisted dynamic braking circuits. These circuits eliminate the contact arcing and failed braking problems associated with other reversing and dynamic braking controls. Dart's zero speed detect circuit also eliminates the motor problems associated with plug reversing a motor by not reapplying power to the motor until zero speed is obtained.

- The 130 series controls are also designed so that upon a power loss condition to the control or an E-stop condition, the control will drop into a dynamic brake condition to safely and quickly bring the motor to a stop and remain there until power is reapplied and a run condition is recognized.

- The 130 series variable speed control come in an extremely small package size and fits the industry standard footprint for both vertical and horizantal mounting patterns.

- The 130 series variable speed control is available in a range of 150mA through 10Adc output at 120Vac or 240Vac input. This represent a Horsepower range of 1/50 through 1 at 90Vdc out or 1/25 through 2 at 180Vdc out.

- The control is designed for DC Permanent Magnet and Shunt Wound motors in the above horsepower ranges.

- Incoming AC voltage is converted to adjustable full wave rectified DC voltage to operate the DC motor. Also, a full wave field voltage is provided for shunt wound motors.

- The control incorporates transient voltage protection with adjustable current limit which fits into a compact package. It also features adjustable IR compensation along with adjustable minimum and maximum speeds settings.

- Available softstart option. (Consult factory for your OEM specific needs)

- c UL us LISTED Listed, file #E78180

CONTROL FEATURES

- **MINIMUM SPEED -** Allows adjustment of the motor speed when the speedpot is set at minimum (CCW). This permits the user to eliminate "Deadband" on the main speed control, permitting zero calibration. Clockwise rotation of "MIN" trimpot increases speed.

- **MAX SPEED (Maximum Speed) -** Allows adjustment of the motor speed when the speedpot is set at maximum (CW). This permits the user to eliminate the top end "Deadband", which will provide full speed at maximum rotation. Rotation of the "MAX" trimpot in the clockwise direction increases the maximum motor speed.

- **I.R. COMP (Speed Regulation) -** This allows for adjustment of the circuitry that controls the speed regulation of the motor. The circuitry controls armature speed by changing the armature voltage to compensate for increased or decreased motor loading. Clockwise rotation of the "IR COMP" trimpot will increase compensation.

- **CUR. LIM. (Current Limit) -** Provides protection from excessive armature current by limiting the maximum armature current the control can provide. This enables adjustment of the maximum torque the motor can deliver. Torque adjustment (Cur. Lim.) is preset at 125% of rated motor torque (current) based on horsepower. Clockwise rotation of the “CUR. LIM.” trimpot increases the torque (current) the control will provide.

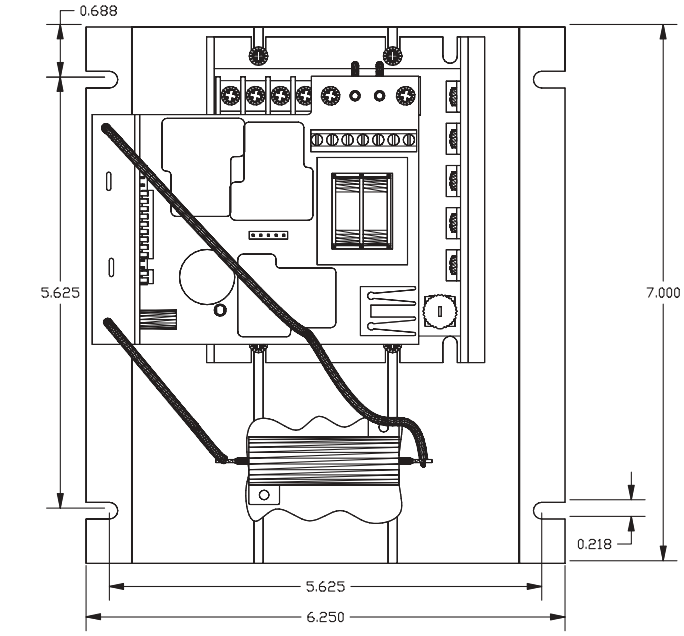
- **BARRIER TERMINAL BLOCKS -** Allows for connection of AC lines, motor leads, motor field (if needed), speed potentiometer and Fwd-Brake-Rev inputs.

- **ONBOARD DYNAMIC BRAKE RESISTOR -** Consult factory for available remote mounting option of Brake resistor.

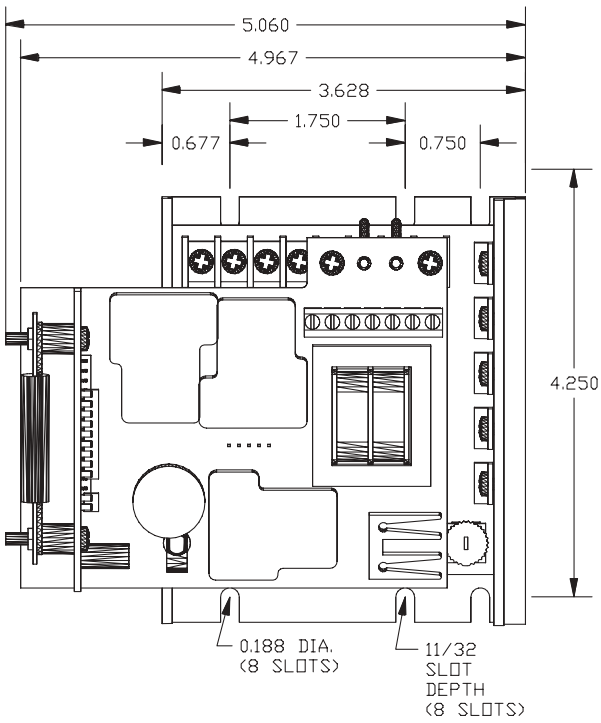
- **POWER LOSS BRAKE -** Upon a power loss to the control or an E-stop command, the control will drop into a dynamic brake condition to safely and quickly bring the motor to a stop and remain there until power is reapplied and a run condition is recognized.

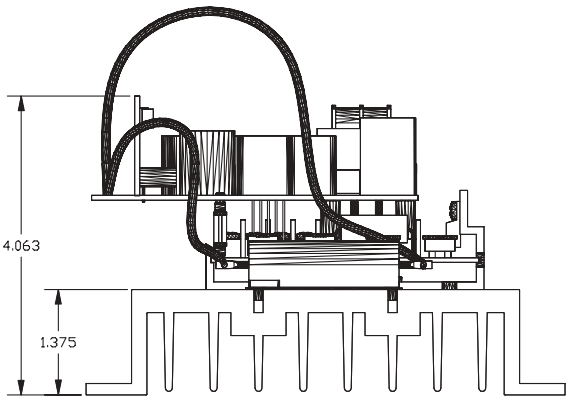
130 SERIES HEATSINK AND MOUNTING DIMENSIONS

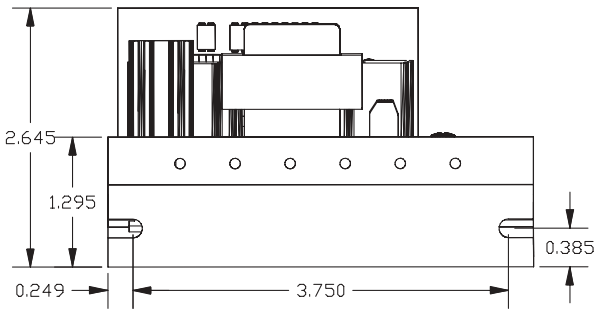
AUXILIARY HEATSINK -HS(125D)



STANDARD HEATSINK







DO NOT MOUNT WHERE AMBIENT TEMPERATURE IS OUTSIDE THE RANGE OF -10° C (15° F) TO 45° C (115° F)

MODEL SELECTION

NOTE: * With suitable external heatsink (where 130 extrusion temperature does not exceed 70° C.), maximum rating for

INPUT VOLTAGE	OUTPUT VOLTAGE	MODEL NUMBER	OUTPUT* AMPS DC	HORSEPOWER
120 VAC	0-90 VDC	130LC12	1.2 ADC	1/50 – 1/8
120 VAC	0-90 VDC	130LC100	5.5 ADC*	1/8 – 1/2*
120 VAC	0-90 VDC	130HC12	1.2 ADC	1/50 – 1/8
120 VAC	0-90 VDC	130HC100	10 ADC*	1/8 – 1
240 VAC	0-180 VDC	132LC25	1.2 ADC	1/25 – 1/4
240 VAC	0-180 VDC	132LC200	5.5 ADC*	1/4 – 1*
240 VAC	0-180 VDC	132HC25	1.2 ADC	1/25 – 1/4
240 VAC	0-180 VDC	132HC200	10 ADC*	1/4 – 2

Output Amps can be increased to 10 ADC output at up to 1Hp at 90VDC or 2Hp at 180VDC.

WIRING PROCEDURE & FUSING

1. Size all wires which carry armature or line currents **AS SPECIFIED BY NATIONAL, STATE, AND/ OR LOCAL CODES.** All other wires may be # 18 AWG or smaller as permitted by local code.

2. **Separate control wires** from the armature and AC lines when routed in conduit or in wire trays.

3. **Fusing** - The motor and control are protected against overloads by the current limit circuit and a customer installed fuse in the AC line. **THIS PROTECTION ALREADY MAY BE PROVIDED BY THE CUSTOMER WITH CIRCUIT BREAKERS OR FUSES IN BOTH MAIN LINES. IF NOT:**

   FOR 120 VAC INPUT - fuse or breaker protection should be added by the customer inline with the Hot AC Line (see following chart).

   FOR 240 VAC INPUT - fuse or breaker protection should be added by the customer inline with both Hot AC Lines (see following chart).

   FUSING ADDED BY CUSTOMER (Bussman ABC or Little Fuse 314 Series ceramic fuses)

HORSEPOWER	120 VAC INPUT	240 VAC INPUT
1/50	2 AMP	----------
1/20	2 AMP	1 AMP
1/8	3 AMP	2 AMP
¼	4 AMP	3 AMP
1/3	6 AMP	3 AMP
½	8 AMP	4 AMP
¾	12 AMP	6 AMP
1.0	15 AMP	8 AMP
1.5	----------	12 AMP
2.0	----------	15 AMP

TERMINAL STRIP WIRING INSTRUCTIONS

Upper board terminal block connections (P4)

P4-1 (AC1 / L) – For single phase AC lines, (120VAC for US or 240VAC for Europe) connect the Hot side of your AC line to this terminal. For systems with two hot AC lines, (240VAC for US) connect either of the Hot AC lines to this terminal.

P4-2 (AC2 / N) – For single phase AC lines, (120VAC for US or 240VAC for Europe) connect the Neutral side of your AC line to this terminal. For systems with two hot AC lines, (240VAC for US) connect either of the Hot AC lines to this terminal.

P4-3 (A1) – For clockwise rotation of your motor in the Fwd. Direction, connect the Plus (+) Armature wire of the motor to this terminal.

P4-4 (A2) – For counter-clockwise rotation of your motor in the Rev. direction, connect the Minus (-) Armature wire of the motor to this terminal.

P4-5 (REV) – This is the reverse direction input terminal. When connected to the COM terminal, the control will release its brake circuit and accelerate to its set point in the reverse direction. When the connection to the COM terminal is opened the control will brake to zero speed. The connection to the COM terminal can be made via a mechanical switch, a relay contact, or an ungrounded solid state open collector type switch. Switching requirements are 5VDC at less than 1ma.

P4-6 (FWD) – This is the forward direction input terminal. When connected to the COM terminal, the control will release its brake circuit and accelerate to its set point in the forward direction. When the connection to the COM terminal is opened the control will brake to zero speed. The connection to the COM terminal can be made via a mechanical switch, a relay contact, or an ungrounded solid state open collector type switch. Switching requirements are 5VDC at less than 1ma.

P4-7 (COM) – This is the common terminal for the forward and reverse speed/dynamic brake commands. **This terminal should not be grounded or tied to any other terminal.**

Lower board terminal block connections (P1)

P1-4 (-A/-F) – DO NOT use for Permanent Magnet Motor. This supplies -Field voltage for a SHUNT WOUND MOTOR (refer to field voltage table). For motors with dual voltage field (ie. 50/100V or 100/200V), make sure highest value is connected. Note: When connecting to this terminal, you will need to use a fork or ring connector placed directly under the screw head.

P1-5 (+F) – DO NOT use for Permanent Magnet Motor. This supplies +Field voltage for a SHUNT WOUND MOTOR (refer to field voltage table). For motors with dual voltage field (ie. 50/100V or 100/200V), make sure highest value is connected.

FIELD VOLTAGE TABLE		
VAC INPUT	120	240
VDC FIELD	100	200

P1-6 (Speedpot Hi) – Connects to high side (white wire) of Speedpot (CW end). This is an internal +12VDC. For start-stop applications, the connection between this terminal and Speedpot HI can be opened and closed by a SPST switch. **INPUT MUST NOT BE GROUNDED!**

P1-7 (Speedpot Wiper) – Connects to wiper (red wire) of Speedpot (center lead). For Voltage Follower applications, this **INPUT MUST NOT BE GREATER THAN +12V MAXIMUM AND MUST NOT BE GROUNDED!**

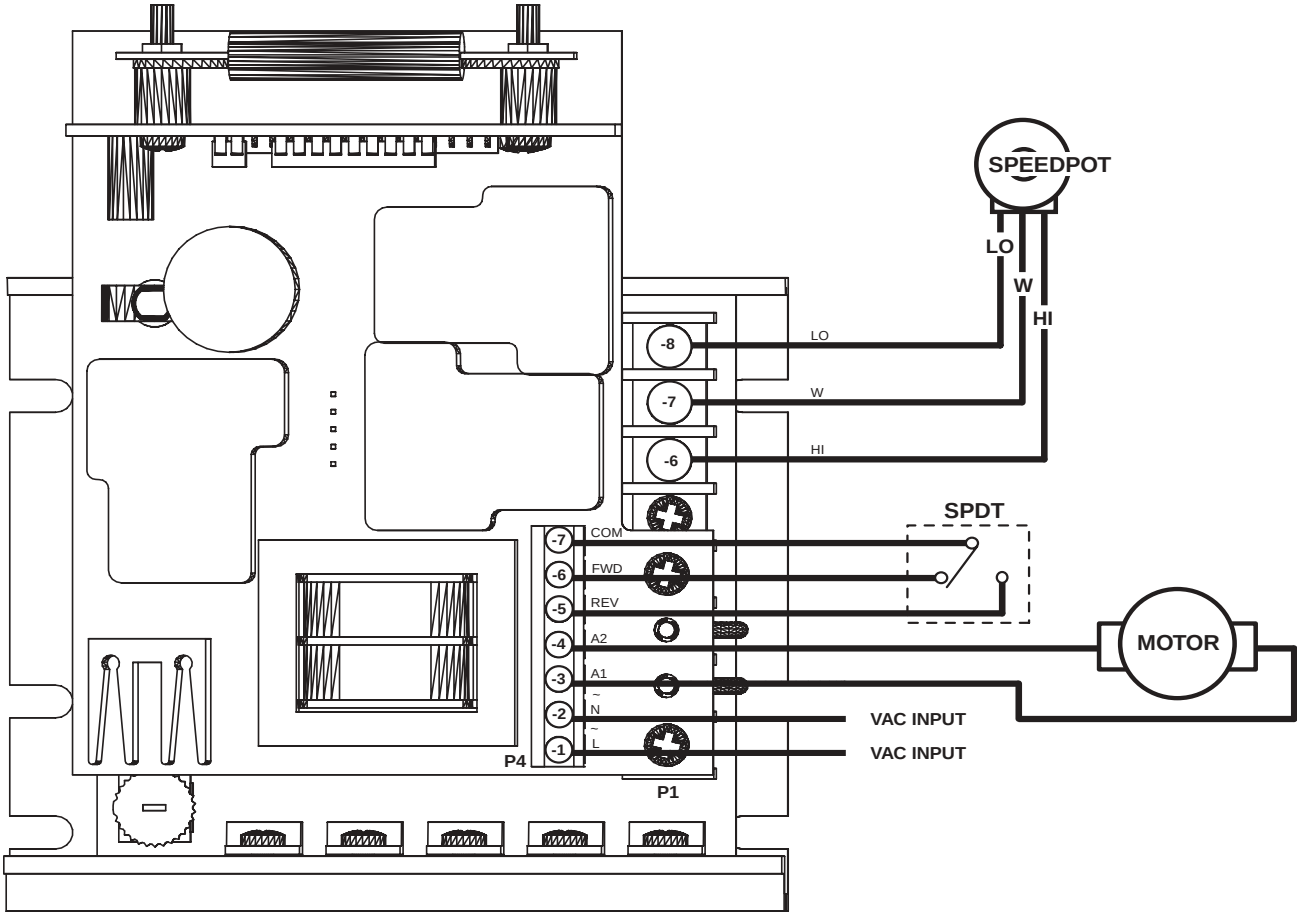
P1-8 (Speedpot Lo) – Connects to Low side (orange wire) of 5K Speedpot (CCW end). This input is raised and lowered by the MIN. trimpot (5K). Electronic speed input (voltage follower) may be referenced to Speedpot LO if the MIN trimpot adjustments are to be active. Otherwise, inputs may be referenced to -ARM, which will bypass the MIN trimpot. **INPUT MUST NOT BE GROUNDED!**

Warning:

1. Be sure the control housing is properly grounded.
2. For non-speedpot applications, the input connection to the LO, WIPER, and HI terminals must not be grounded! Serious control damage may result from a grounded input.

130 HOOK-UP DIAGRAM

Warning:
Do not attempt to perform Hi-pot test across AC lines with control in circuit.
This will result in immediate or long term damage to the control.



CONTROL START-UP

WARNING: ALL POWER MUST BE TURNED OFF BEFORE PROCEEDING!

1. Recheck all wiring. Accidental grounds to loose or pinched wires on the armature or speedpot wires may damage the control when power is applied.

2. Check to see that incoming service is of correct voltage.

3. Turn speedpot to zero (fully CCW).

4. Turn power on, close contact from COM(P4-7) to either FWD(P4-6) or REV(P4-5) and advance speedpot while observing motor rotation. **Power must be off before step 5 can be accomplished!**

5. If motor rotation is incorrect for the direction selected, turn power off at external disconnect and reverse the A1 and A2 motor connections.

6. Check for satisfactory operation throughout the speed range.

7. Open the FWD/REV connection to COM to verify motor brakes to zero speed.

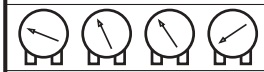
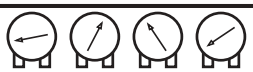
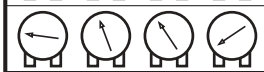
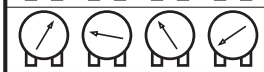
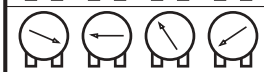
8. If operation is satisfactory, no readjustments are needed.

9. If instability or surging is observed, or if maximum and minimum speed settings need further adjustments then see “TRIMPOT ADJUSTMENT CHART & PROCEDURE”.

10. For other problems, consult page 10, “IN CASE OF DIFFICULTY”.

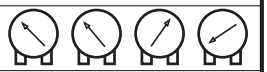
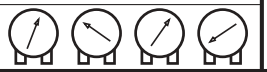
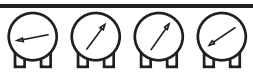
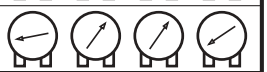
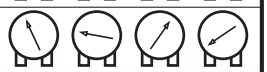
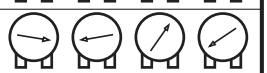
TRIMPOT ADJUSTMENT CHART & PROCEDURE

Settings apply when using a 5K ohm master speedpot. This chart is used in conjunction with the adjustment procedure and is approximate.

	C.L. I.R. MAX MIN	HP
130LC12 130HC12 120 VAC input; 0-90 VDC output		**1/50**
		**1/20**
		**1/8**
130LC100 130HC100 120 VAC input; 0-90 VDC output		**1/8**
		**1/4**
		**1/3**
		**1/2**
		**3/4***
		**1.0***

Operation of the control beyond ±10% of the normal line voltage could result in re-adjustment. These adjustments are permanent; periodic re-adjustment is normally not needed.

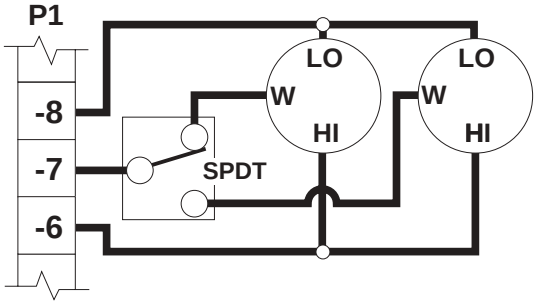
Settings apply when using a 5K ohm master speedpot. This chart is used in conjunction with the adjustment procedure and is approximate.

HP	C.L. I.R. MAX MIN	
1/20		**132LC25 132HC25** 240 VAC input; 0-180 VDC output
1/8		
1/4		
1/4		**132LC200 132HC200** 240 VAC input; 0-180 VDC output
1/3		
1/2		
3/4*		
1.0*		
1.5*		
2.0*		

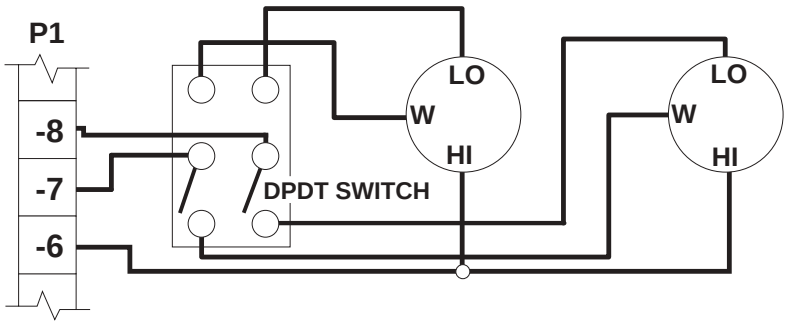
CONTROL MODIFICATIONS

TRIMPOT	FUNCTION	ADJUSTMENT
MIN.	Sets minimum motor speed when speedpot is set at zero. CW rotation will increase minimum motor speed.	1. Select a direction and set Speedpot to zero (fully CCW). 2. Rotate MIN trimpot CW until motor starts to rotate 3. Slowly rotate MIN trimpot CCW until motor stops. NOTE: If motor rotation is desired, rotate MIN trimpot CW until desired MIN speed is reached
IR COMP	Provides a means of improving motor speed regulation. If a slowdown due to load change is of no concern, rotate this trimpot fully CCW.	1. Select a direction and set Speedpot at 50%. 2. Observe motor speed at no load condition. 3. Apply full load to motor. 4. Turn IR COMP trimpot CW until you obtain the same motor speed as the no load condition.
MAX.	Sets maximum motor speed when speedpot is set at maximum (fully CW rotation). CW rotation of MAX trimpot increases maximum motor speed.	1. TURN DRIVE POWER OFF!! 2. Connect a DC Voltmeter across A1 and A2. **NOTE: Meter must not be grounded!!** 3. Set meter voltage range if needed: (90 VDC for 120 VAC, 180VDC for 240 VAC). 4. Turn power on. Select a direction and set Speedpot at100%. 5. Adjust the MAX trimpot to rated motor armature voltage as shown on meter. NOTE: A tachometer or strobe may be used in lieu of a meter. Follow above steps, except adjust MAX trimpot to rated motor base speed indicated by tachometer or strobe.
CUR.LIM.	Limits DC motor armature current (torque) to prevent damage to the motor or control. The current limit is set for the rated motor current. CW rotation of this trimpot increases the armature current (or torque produced).	1. TURN DRIVE POWER OFF! 2. Connect a DC Ammeter between A1 on motor and A1 on the control. This is in series with the motor. **NOTE: Meter must not be grounded!!** 3. Turn power on. 4. Select a direction and set Speedpot at the 50% position. 5. Apply friction braking to motor shaft until motor stalls. 6. With motor stalled, set current at 125% of rated motor armature current by adjusting CUR. LIM . trimpot.

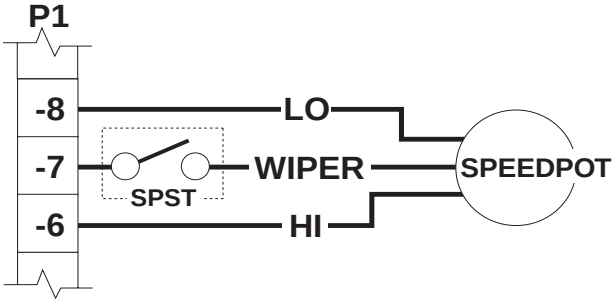
TWO SPEED OPERATION USING TWO 10K SPEEDPOTS



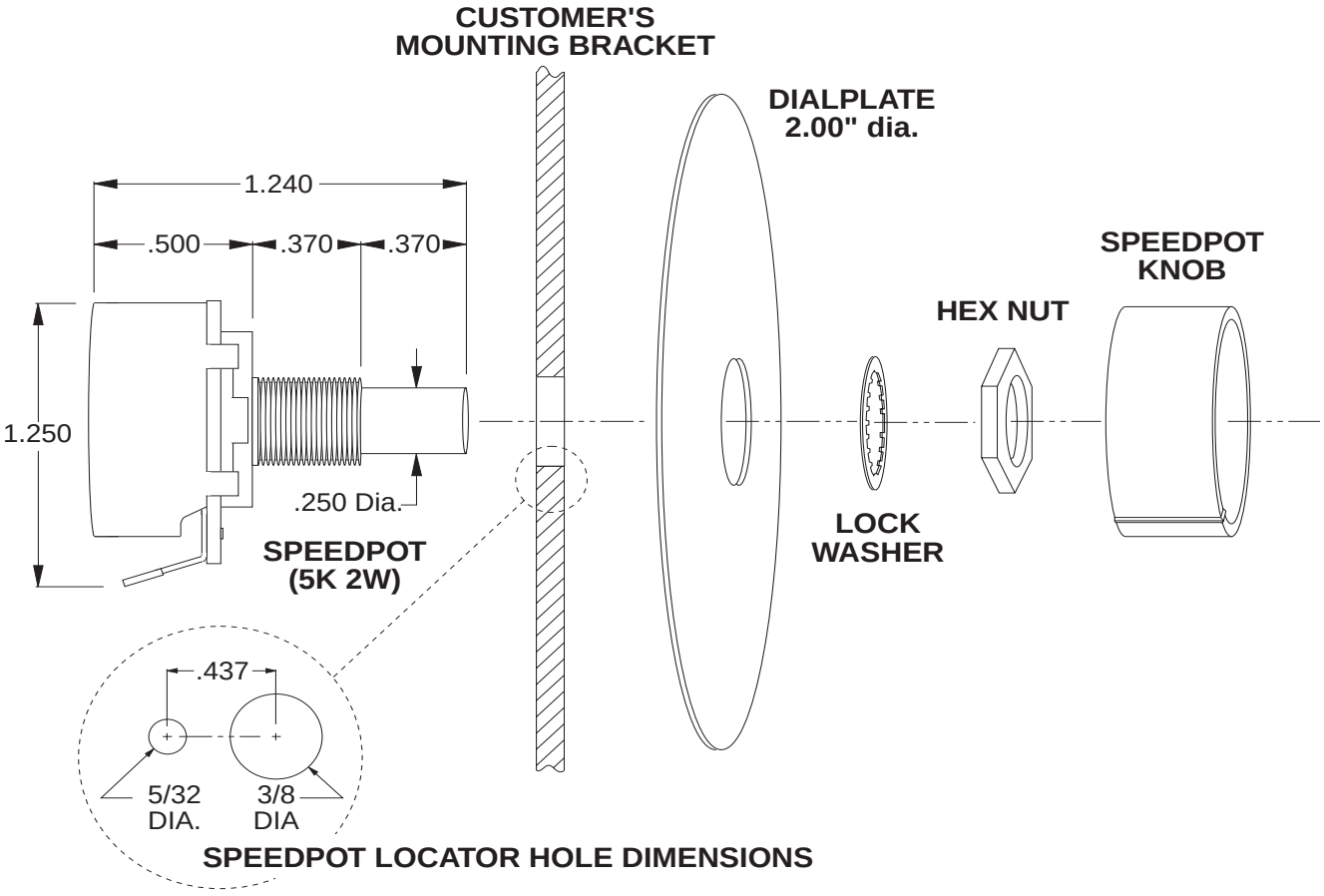
TWO SPEED OPERATION USING TWO 5K SPEEDPOTS



INHIBIT



SPEEDPOT KIT ASSEMBLY



OPTION DESCRIPTIONS

-K option

Acceleration Time Ranges — Factory Installed

This option provides the Accel time shown below. The standard Accel time is 0.5 seconds.

ACCELERATION TIME ---------- 6 seconds

USE STANDARD HOOK-UP

IN CASE OF DIFFICULTY

PROBLEM	POSSIBLE CAUSE(S)	CORRECTIVE ACTION(S)
Motor doesn't operate	**- Blown Fuse or Breaker** **- Incorrect or no power source** **- Speedpot set at Zero** **- Worn motor brushes**	**Replace Fuse or reset breaker** **Install proper service** **Adjust Speedpot CW to start** **Replace brushes**
Armature output voltage cannot be adjusted, output is a constant DC level **Motor stalls, or runs very slowly with speed control turned fully CW**	**- No motor or load connected** **- Speedpot low connection open** **- Low Voltage** **- Overload Condition** **- Worn motor brushes** **- MAX SPEED set incorrectly**	**Check that motor or load is connected to armature terminals** **Check that speedpot low wire is connected** **Check that VAC is above 100VAC** **Reduce load or increase motor size and/or C.L. setting.** **Replace brushes** **See ADJUSTMENT PROCEDURE**
Motor hunts	**- Motor current less than 150Ma** **- Too much IR COMP** **- Motor is in current limit** **- Motor speed is above rated speed** **- Max set too high**	**Motor current must be greater than 150mA D.C.** **See ADJUSTMENT PROCEDURE** **See ADJUSTMENT PROCEDURE** **Reduce Speed** **See ADJUSTMENT PROCEDURE**
Repeated fuse blowing	**- Low Voltage** **- Overload Condition** **- Worn motor brushes** **- Defective motor bearings** **- Defective electrical components**	**Check that VAC is above 100VAC** **Reduce load** **Replace** **Replace** **Call Dart Distributor or Representative**

If control still will not operate, consult your Dart Distributor or Representative.

SPECIFICATIONS

AC input voltage ---------- ±10% of rated line voltage
Acceleration ---------- 0.5 seconds standard 125D
Amps - DC output; (Models 130XX12 & 132XX25) ---------- 150 mA to 1.2 ADC
(Models 130LC100 & 132LC200) ---------- 150 mA to 5.5 ADC*
(Models 130HC100 & 132HC200) ---------- 150 mA to 10 ADC
Controller overload capacity ---------- 200% for one minute
Current limit trimpot range; (Models 130XX12 & 132XX25) ---------- 0.3 to 3 ADC
(Models 130XX100 & 132XX200) ---------- 1 to 18 ADC
Deceleration 0.5 seconds (standard 125D)
Dimensions and weights:

LC MODELS	W	L	D	WEIGHT
ENGLISH	4.967”	4.250”	2.688”	1.08lb.
METRIC	126.16mm	107.95mm	68.27mm	489.87g
HC MODELS	**W**	**L**	**D**	**WEIGHT**
ENGLISH	6.250”	7.000”	4.063”	3.30lb.
METRIC	158.75mm	177.80mm	103.20mm	1496.80g

Drive service factor ---------- 1.0
Efficiency ---------- 85% typical
Input frequency ---------- 50 or 60 Hertz
Max. trimpot speed range ---------- 60% to 110% of base speed
Min. trimpot speed range ---------- 0% to 30% of maximum speed
Power devices ---------- isolated case tab
Shunt field voltage ---------- 100VDC for 120VAC input; 200VDC for 240VAC input
Shunt field current ---------- 1 amp DC maximum
Speed control ---------- via 5Kohms .5W potentiometer or 0-10VDC isolated signal
Speed range ---------- 50:1
Speed regulation ---------- ±1% of base speed
Temperature range ---------- -10° to 45° C. ambient (15° to 115° F.)
Terminal Block Torque Setting ---------- 4.4 in. lb. Max or .5Nm
Transient protection ---------- G-Mov
Trigger ---------- opto-isolator
Start/Brake cycle per minute (LC Models) ---------- 3 per min**
(HC Models) ---------- 30 per min**

Approval ---------- c UL us LISTED

* With suitable external heatsink (where 130 extrusion temperature does not exceed 70° C.), maximum rating for output amps can be increased to 10 amps D.C.

** Cycles per minute are based on typical inertia type loads. Higher cycle per minute rates may be achieved with constant torque or low inertia type loads. Lower cycle rates may be required for very high inertia type loads.

TYPICAL MOTOR CURRENTS

Horsepower	1/50	1/20	1/8	1/4	1/3	1/2	3/4	1.0	1.5	2.0
Typical AC Amps (120VAC)	0.50	1.00	2.00	3.50	4.40	6.50	9.30	13.20	-----	-----
Typical Arm Amps (120VAC)	0.42	0.81	1.60	2.70	3.40	5.00	8.20	10.90	-----	-----
Typical AC Amps (240VAC)	-----	0.80	1.20	1.80	2.20	3.30	4.80	6.50	9.70	12.90
Typical Arm Amps (240VAC)	-----	0.40	0.60	1.40	1.70	2.50	3.70	5.00	8.20	11.60

- Notes -

- Notes -

REPAIR PROCEDURE

In the event that a Product manufactured by Dart Controls Incorporated (DCI) is in need of repair service, it should be shipped, freight paid, to: Dart Controls, Inc., 5000 W. 106th Street, Zionsville, IN. 46077, ATTN: Repair Department.

Those orders received from anyone without and existing account with DCI will need to specify if they will be paying COD or Credit Card (Master Card or Visa). This information is required before work can begin. If you have an account with Dart your order will be processed according to the terms listed on your account.

Completed repairs are returned with a Repair Report that states the problem with the control and the possible cause. Repair orders are returned via UPS Ground unless other arrangements are made. If you have further questions regarding repair procedures, contact your Dart Controls, Inc. at 317-733-2133 Ext.460.

YOUR MOTION SYSTEMS SOLUTION PROVIDER

125D SERIES
AC INPUT - VARIABLE DC OUTPUT
1/50 HP through 1.0 HP

250G SERIES
AC INPUT - VARIABLE DC OUTPUT
1/50 HP through 2.0 HP

65 SERIES
DC INPUT - VARIABLE DC OUTPUT
CURRENT RATINGS OF 20, 40, AND 60 AMPS

700/COMMUTROL SERIES
DC BRUSHLESS
5 & 20 Amp for
12,24,& 36VDC Inputs

MDP SERIES
PROGRAMMABLE
CLOSED LOOP DC
SPEED CONTROL

DM SERIES
FIELD PROGRAMMABLE
DIGITAL TACHOMETER

Dart Controls, Inc. is a designer, manufacturer, and marketer of analog and digital electronic variable speed drives, controls, and accessories for AC, DC, and DC brushless motor applications.

Shown above is just a sampling of the expanded line of Dart controls that feature the latest in electronic technology and engineering. Products are manufactured in the U.S.A. at our Zionsville (Indianapolis, Indiana) production and headquarters facility - with over 2,000,000 variable speed units in the field.

In addition to the standard off-the-shelf products, you can select from a wide variety of options to customize controls for your specific application. For further information and application assistance, contact your local Dart sales representative, stocking distributor, or Dart Controls, Inc.

Dart Controls, Inc.

Manufacturer of high quality DC and AC motor speed controls and accessories since 1963.

P.O. Box 10
5000 W. 106th Street
Zionsville, Indiana 46077
Phone: (317) 733-2133
Fax: (317) 873-1105

www.dartcontrols.com

ISO9001:2000 REGISTERED

250G CONTROL SERIES

DART CONTROLS

Instruction Manual

Variable Speed DC Control

P.O. Box 10
5000 W. 106th Street
Zionsville, Indiana 46077

Phone (317) 873-5211
Fax (317) 873-1105
www.dartcontrols.com

TABLE OF CONTENTS

WARRANTY

Dart Controls, Inc. (DCI) warrants its products to be free from defects in material and workmanship. The exclusive remedy for this warranty is DCI factory replacement of any part or parts of such product which shall within 12 months after delivery to the purchaser be returned to DCI factory with all transportation charges prepaid and which DCI determines to its satisfaction to be defective. This warranty shall not extend to defects in assembly by other than DCI or to any article which has been repaired or altered by other than DCI or to any article which DCI determines has been subjected to improper use. DCI assumes no responsibility for the design characteristics of any unit or its operation in any circuit or assembly. This warranty is in lieu of all other warranties, express or implied; all other liabilities or obligations on the part of DCI, including consequential damages, are hereby expressly excluded.

NOTE: Carefully check the control for shipping damage. Report any damage to the carrier immediately. Do not attempt to operate the drive if visible damage is evident to either the circuit or to the electronic components.

All information contained in this manual is intended to be correct, however information and data in this manual are subject to change without notice. DCI makes no warranty of any kind with regard to this information or data. Further, DCI is not responsible for any omissions or errors or consequential damage caused by the user of the product. DCI reserves the right to make manufacturing changes which may not be included in this manual.

WARNING

Improper installation or operation of this control may cause injury to personnel or control failure. The control must be installed in accordance with local, state, and national safety codes. Make certain that the power supply is disconnected before attempting to service or remove any components!!! If the power disconnect point is out of sight, lock it in disconnected position and tag to prevent unexpected application of power. Only a qualified electrician or service personnel should perform any electrical troubleshooting or maintenance. At no time should circuit continuity be checked by shorting terminals with a screwdriver or other metal device.

INTRODUCTION

- The Dart 250G Series variable speed DC motor control is a versatile, general purpose control rated to 2 HP, available in chassis mount or enclosed configurations; with options for specific applications.
- The 251G model is available with an adjustable HP range of 1/50 thru 1/8 at 120 VAC input.
- The 253G model has a dual voltage input (may accommodate either 120 or 240 VAC). It is available with an adjustable HP range of 1/8 thru 1 HP for 120 VAC, and 1/4 thru 2 HP for 240 VAC input.
- Designed for DC Permanent Magnet, Shunt Wound, and some Universal (AC/DC) motors in the above horsepower ranges.
- Incoming AC voltage is also converted to adjustable full wave rectified DC voltage (via a packaged bridge) to operate the DC motor. Also, a full wave field voltage is provided for shunt wound motors (see page 4 for voltages).
- The control incorporates transient voltage protection with adjustable current limit and an AC fuse for protection. It features adjustable minimum and maximum speeds along with adjustable acceleration and IR Compensation. Tach feedback is accomplished thru a connection to a pin (P2) on the printed circuit board.
- The 250G Series has a linear acceleration/deceleration ramp.
- The control also has a barrier type terminal strip for all power and control wiring.
- The enclosed model uses a gasketed cover assembly that is rated NEMA 4/12.
- cU.L.us Listed.

CONTROL FEATURES

MIN. SPEED (minimum speed) - Allows adjustment of the motor speed when the speedpot is set at minimum (CCW). This permits the user to eliminate the “deadband” on the main speed control permitting zero calibration. Clockwise rotation of “MIN” trimpot increases minimum motor speed.

MAX. SPEED (maximum speed) - provides for adjustment of the motor speed when the speedpot is set at maximum (CW). This permits the user to eliminate the top end “deadband”, which will provide full speed at maximum rotation. Rotation of the “MAX” trimpot in the clockwise direction increases the maximum motor speed.

ACCEL (acceleration) - allows adjustment of the motor acceleration from a minimum of 0.5 seconds to approximately 8.0 seconds. The deceleration time depends on the ACCEL setting. For DECEL time equal to ACCEL time, see -17B option.

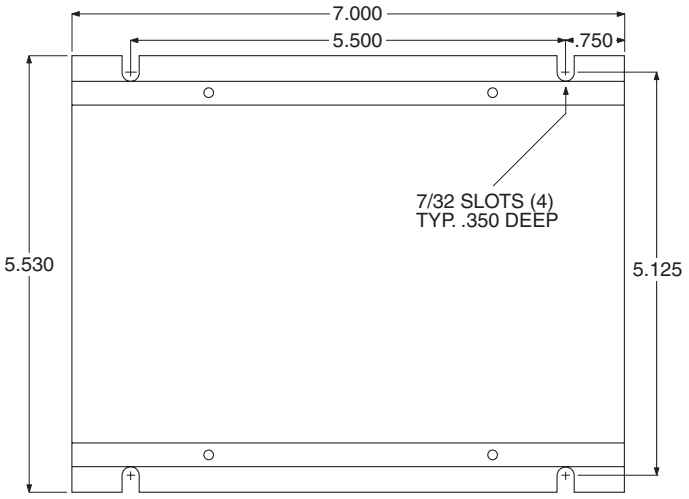
I. R. COMP (speed regulation) - adjusts the control output to compensate for speed changes caused by varying motor loads. As the motor load is increased, I.R. COMP increases the voltage output of the control. Clockwise rotation of the “I.R. COMP” trimpot will increase compensation.

CUR. LIM. (current limit) - provides protection from excessive armature current by limiting the maximum armature current the control can provide. This enables adjustment of the maximum torque the motor can deliver. Current limit adjustment (CUR LIM) is set at 125% of the rated motor current (torque) based on horsepower. Clockwise rotation of the “CUR LIM” trimpot increases the current (torque) the control will provide.

INHIBIT TERMINAL PIN (P2) - allows the user a choice of stopping and starting hard (fast) or stopping hard with a soft start through an adjustable acceleration ramp, without breaking the AC lines (see page 8).

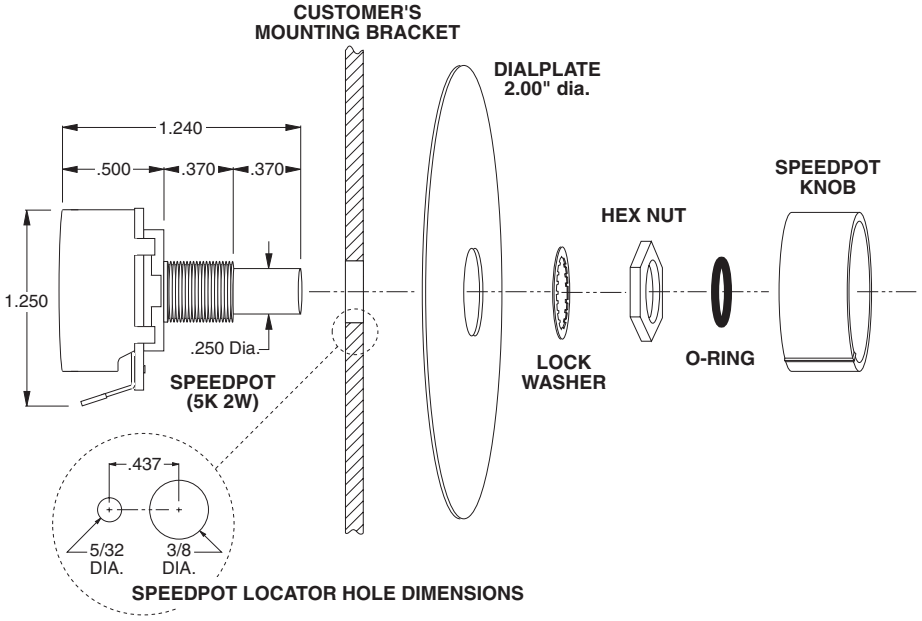
TERMINAL STRIP - allows for connection of AC lines, motor leads, motor field (if needed), and speed potentiometer.

HEATSINK DIMENSIONS



FOR CHASSIS VERSION: Allow 1.55" for height clearance, 7.00" for overall length.
FOR ENCLOSED VERSION: Allow 3.50" for height clearance, 7.40" for overall length.

SPEEDPOT KIT ASSEMBLY



MOUNTING PROCEDURE

CAUTION: Do not mount control where ambient temperature is outside the range of -10° C. (15° F.) to 45° C. (115° F.)

1. Four 7/32" diameter slots are provided for control mounting.
2. The chassis of the control can be used as a template.
3. Use standard hardware to mount.
4. The enclosed version has two threaded holes (1/2" NPT) provided on the bottom side endplate near the terminal strip to facilitate wiring.

MODEL SELECTION

Note: The minimum current rating for all 250G controls is 150mA.

HORSEPOWER	INPUT VOLTAGE	OUTPUT VOLTAGE	OUTPUT AMPS DC	CHASSIS MODEL	ENCLOSED MODEL
1/50 1/20 1/8	120 VAC	0-90 VDC	1.2A	251G-12C	251G-12E
1/8 1/4 1/3 1/2 3/4 1.0	120/240 VAC	0-90/0-180 VDC	10.8A	253G-200C	253G-200E
1.5* 2.0*	240 VAC	0-180 VDC	10.8A	253G-200C	253G-200E

* Not available with 120 VAC input - Input voltage determines maximum allowable H.P.

The 251G will operate a 90 VDC motor in the H.P. range of 1/50 through 1/8 H.P., using different trimpot settings. The 253G will operate a 90 VDC motor in the H.P. range of 1/8 through 1 H.P., and a 180 VDC motor in the range of 1/4 through 2 H.P., using different trimpot settings.

WARNING

1. **Be sure the control housing is properly grounded.**
2. **Arm connections must not be switched or broken while the control is on. Serious damage may result.**
3. **For non-speedpot applications, the input connections to the Lo-Wiper-Hi leads must not be grounded. Serious control damage may result from a grounded input.**

WIRING PROCEDURE

1. **Size all wires** which carry armature or line current to handle currents as specified by national, state, and/or local codes. All other wires may be #18 AWG or smaller as permitted by local code.
2. **Separate control wires** from all the Armature and AC line wires when routed in conduits or in wire trays. The enclosed version has two threaded holes (1/2" NPT) in one endplate, located near the terminal strip, for this purpose.

FUSING

The 250G is provided with a fuse in AC line 1 (P1-11). This fuse is sized to open in the event of a shorted armature or if an armature line is shorted to earth ground. As long as 120 VAC input is connected properly, there is no additional fusing needed.

For 240 VAC applications, an external fuse may be used in AC line 2 (P1-10). This fuse should be a Bussman ABC10 or LittleFuse 314-010. This added fuse will provide protection on both AC legs to the 250G. If you desire not to fuse both legs, the fuse in the control will open in the event of excessive armature currents.

Note: AC current is determined by motor characteristics. In some applications it may be necessary to increase fuse value.

TERMINAL STRIP WIRING

The 250G Series has an 11 position terminal strip for ease of connection.

P1-1 **(SPEEDPOT LO)** Connects to low side (orange wire) of the 5K speedpot (normally the CCW end). This input is raised and lowered by the MIN. trimpot. Electronic speed input (voltage follower) may be referenced to speedpot LO if the MIN trimpot adjustments are to be active. Otherwise, inputs may be referenced to -ARM, which will bypass the MIN trimpot.
NOTE: INPUT MUST NOT BE GROUNDED!!

P1-2 **(SPEEDPOT WIPER)** Connects to wiper (red wire) of the 5K speedpot (center lead). For voltage follower applications, this **INPUT MUST NOT BE GREATER THAN +12 VOLTS MAXIMUM AND MUST NOT BE GROUNDED!**

P1-3 **(SPEEDPOT HI)** Connects to high side (white wire) of the 5K speedpot (CW end). This is internal +12 volts. For start-stop applications, the connection between this terminal and speedpot HI can be opened and closed by a SPST switch.
NOTE: INPUT MUST NOT BE GROUNDED!!

P1-4 **(-ARM)** Connects to minus (-) Armature wire (A2) on motor. For voltage follower applications where the MIN trimpot is bypassed, connect minus (-) of the follower to this terminal.

P1-5 **(+ARM)** Connects to plus (+) Armature wire (A1) on motor. 0-90 VDC for 120 VAC input OR 0-180 VDC for 240 VAC input. See “SPECIFICATIONS” for output rating.

P1-6 **(+FIELD)** DO NOT USE for permanent magnet motor. This supplies +Field voltage for a SHUNT WOUND MOTOR. Refer to Field Voltage table. For motors with dual voltage field (i.e. 50/100V or 100/200V), make sure highest value is connected.

FIELD VOLTAGE TABLE		
VAC INPUT	**120**	**240**
VDC FIELD	**100**	**200**

P1-7 **(-FIELD)** Connect minus (-) Field wire of SHUNT WOUND MOTOR.

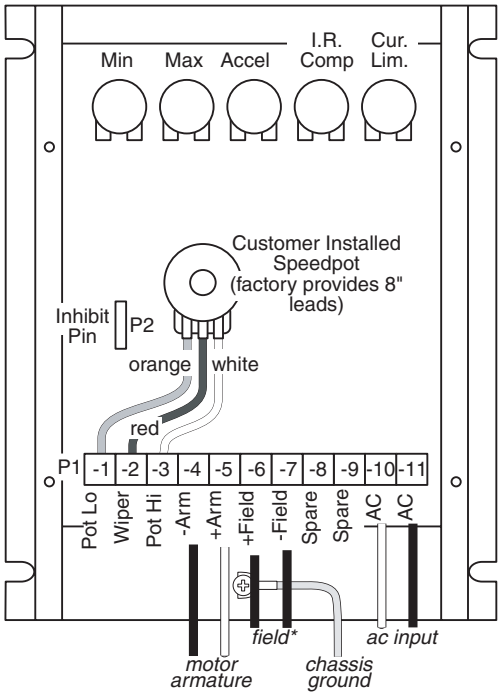
P1-8 } **VERY IMPORTANT !!!** **Refer to “CUSTOMER FUSING”, shown above.**
P1-9 } **CHASSIS VERSION:** **(SPARE)** Make no connection to P1-8 or P1-9

ENCLOSED VERSION: **(AC)** ***120VAC*** - Connect incoming hot AC (black wire) to P1-9 and Neutral (white wire) to P1-8. Connect ground (green wire) to Chassis Ground, as shown in diagram - page 5.
240VAC - Connect both hot sides, one to P1-8 and one to P1-9. Also connect ground wire to Chassis Ground.

P1-10 } **VERY IMPORTANT !!!** **Refer to “CUSTOMER FUSING”, shown above.**
P1-11 } **CHASSIS VERSION:** **(AC)** ***120VAC*** - Connect incoming hot AC (brown or black wire) to P1-11 and Neutral (white or yellow wire) to P1-10. Connect ground (green wire) to Chassis Ground.
240VAC - Connect both hot sides, one to P1-10 and one to P1-11. Connect ground wire to Chassis Ground.

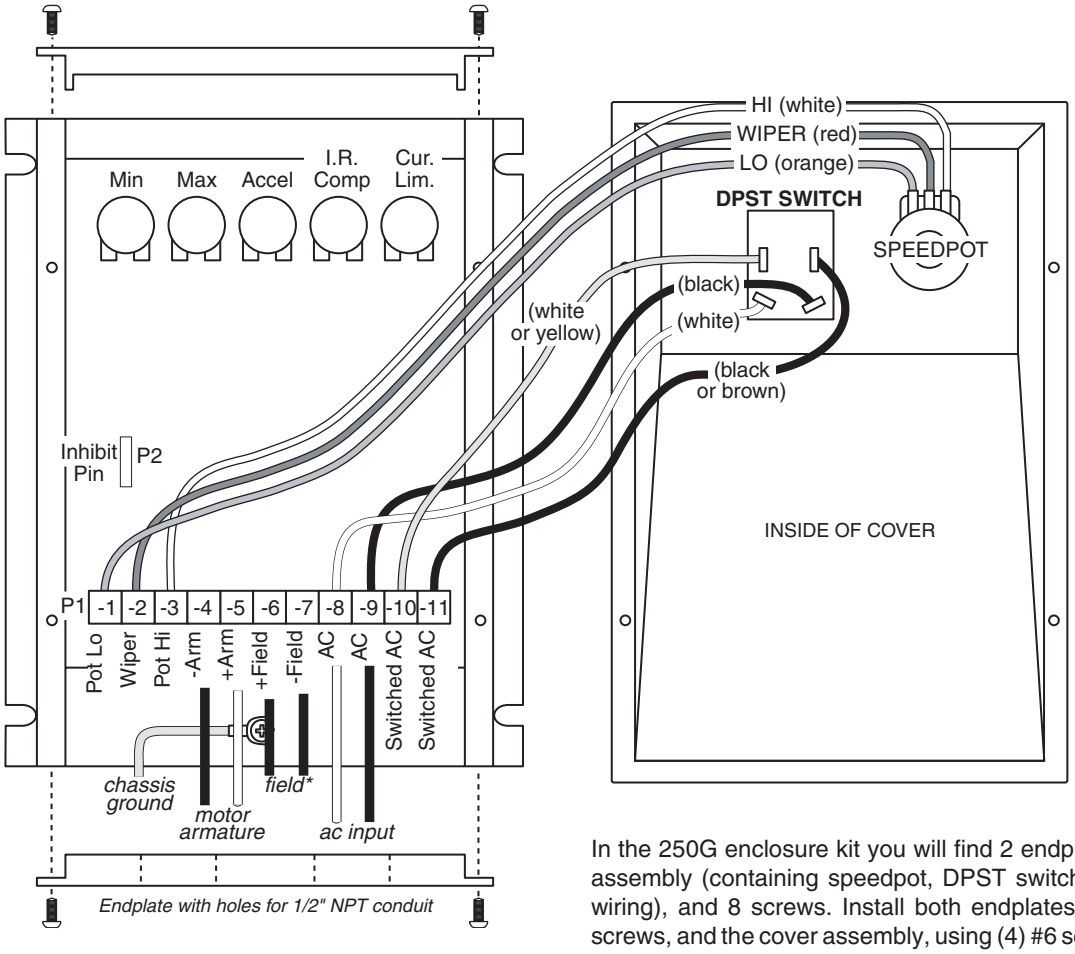
ENCLOSED VERSION: **(SWITCHED AC)** No connections to P1-10 and P1-11. This is for switched AC output. Note “FACTORY WIRING” (page 5). Pilot lights can be connected between these terminals. The voltage present at these terminals is AC input voltage.

250G SERIES CHASSIS HOOK-UP DIAGRAM



* Used for shunt wound motors only! No connection is made to these terminals when using permanent magnet motors.

250G SERIES ENCLOSED HOOK-UP DIAGRAM



* Used for shunt wound motors only! No connection is made to these terminals when using permanent magnet motors.

In the 250G enclosure kit you will find 2 endplates, a cover assembly (containing speedpot, DPST switch, gasket and wiring), and 8 screws. Install both endplates using (4) #5 screws, and the cover assembly, using (4) #6 screws. Before screwing down cover assembly, route wiring through conduit holes in endplate by terminal strip.

Warning: Do not attempt to perform a Hi-Pot test across AC lines with control in circuit. This will result in immediate or long term damage to the control.

START-UP PROCEDURE

WARNING: ALL POWER MUST BE TURNED OFF BEFORE PROCEEDING !!!

1. Recheck all wiring. Accidental grounds, loose or pinched wires on armature or speedpot wires may damage the control when power is applied.
2. Check to see that incoming service is of correct voltage.
3. Turn speedpot to zero (fully CCW).
4. Turn power on and advance speedpot while observing motor.
   WARNING: POWER MUST BE OFF BEFORE STEP 5 CAN BE ACCOMPLISHED!
5. If motor rotation is incorrect, turn power off at external disconnect and reverse +ARM and -ARM connections.
6. Check for satisfactory operation throughout the speed range.
7. If operation is satisfactory, no readjustments are needed.
8. If instability or surging is observed, or maximum speed is higher than desired, see section “TRIMPOT ADJUSTMENT”.
9. For other problems, consult section “IN CASE OF DIFFICULTY”.

ADJUSTMENTS

The trimpot adjustments, MIN, MAX, I.R. COMP, and CUR LIM are checked at the factory using a typical motor at 240 VAC input. Use the **TRIMPOT SETTING CHART** on page 7 to preset the trimpots for the proper setting for your application. The remaining trimpot - ACCEL, is a variable acceleration and should be set for your particular application.

The trimpot chart is approximate. The chart is valid when using the speedpot or a 0-10/12 VDC input signal to set speed.

These adjustments are permanent; periodic readjustment is normally not needed. Operation of the control beyond ±10% of normal line voltage could result in readjustments.

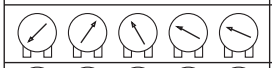
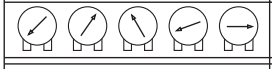
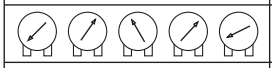
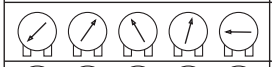
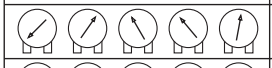
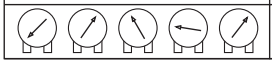
TRIMPOT ADJUSTMENT PROCEDURE

TRIMPOT	FUNCTION	ADJUSTMENT
MAX	**SETS MAXIMUM MOTOR SPEED when speedpot is set at maximum (100% rotation CW). CW rotation of MAX trimpot increases maximum motor speed.**	1. TURN DRIVE POWER OFF!! 2. Connect DC Voltmeter: + to +ARM, - to -ARM. 3. Set meter voltage range: (90VDC or 180VDC). 4. Turn power on. Set speedpot at 100%. 5. Adjust MAX trimpot to rated motor armature voltage as shown on meter. NOTE: A tachometer or strobe may be used in lieu of a meter. Follow above steps, except adjust MAX trimpot to rated motor base speed indicated by tachometer or strobe.
MIN	**SETS MINIMUM MOTOR SPEED when speedpot is set at zero. CW rotation will increase minimum motor speed.**	1. Set speedpot to zero (fully CCW). 2. Rotate MIN trimpot CW until motor rotates. 3. Slowly rotate MIN trimpot CCW until motor stops. NOTE: If motor rotation at zero is desired, rotate MIN trimpot CW until desired minimum speed is reached.
I.R. COMP.	**CALIBRATES SPEED REGULATION - Provides a means of improving motor speed regulation in the armature feedback mode. If a slowdown due to load change is of no concern, rotate this trimpot fully CCW.**	1. Set speedpot at 50%, 2. Observe motor speed at no load condition. 3. Apply a full load to the motor. 4. Adjust IR COMP trimpot CW to obtain the same motor speed as with no load.
CUR. LIM.	**LIMITS DC MOTOR ARMATURE CURRENT (Torque) to prevent damage to the motor or control. The current limit is set for the rated motor current. CW rotation of this trimpot increases the armature current (or torque produced).**	1. TURN DRIVE POWER OFF !! 2. Connect a DC ammeter between A1 on the motor and +ARM on the control. This is in series with the motor. 3. Turn power on. 4. Set speedpot at the 50% position. 5. Set CUR LIM trimpot fully CCW. 6. Apply friction braking to the motor shaft until motor is stalled (zero RPM). 7. While motor is stalled, set current at 125% of rated nameplate motor armature current by adjusting the CUR LIM trimpot.
ACCEL	**ALLOWS ADJUSTMENT OF ACCELERATION by user.**	1. CW rotation increases time of acceleration.

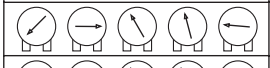
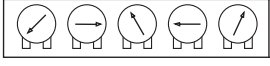
TRIMPOT SETTING CHART

* These settings apply when using a 5000Ω Master Speedpot.
* Settings will differ when using various options, such as using the -5 or the -7 option. For the -17B option, Accel/Decel is 20 seconds when pot is turned fully clockwise.
* This trimpot chart is approximate. Use it in conjunction with the Adjustment Procedures.

2510G / 2530G

MIN MAX ACCEL I.R. C.L.	H.P.	INPUT VOLTAGE	OUTPUT VOLTAGE
	1/50	120VAC	0-90VDC
	1/20	120VAC	0-90VDC
	1/8	120VAC	0-90VDC
	1/8	120VAC	0-90VDC
	1/4	120VAC	0-90VDC
	1/3	120VAC	0-90VDC
	1/2	120VAC	0-90VDC
	3/4	120VAC	0-90VDC
	1.0	120VAC	0-90VDC

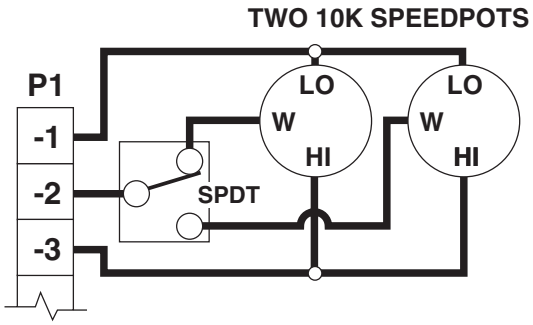
2530G

MIN MAX ACCEL I.R. C.L.	H.P.	INPUT VOLTAGE	OUTPUT VOLTAGE
	1/4	240VAC	0-180VDC
	1/2	240VAC	0-180VDC
	3/4	240VAC	0-180VDC
	1.0	240VAC	0-180VDC
	1.5	240VAC	0-180VDC
	2.0	240VAC	0-180VDC

CONTROL MODIFICATIONS

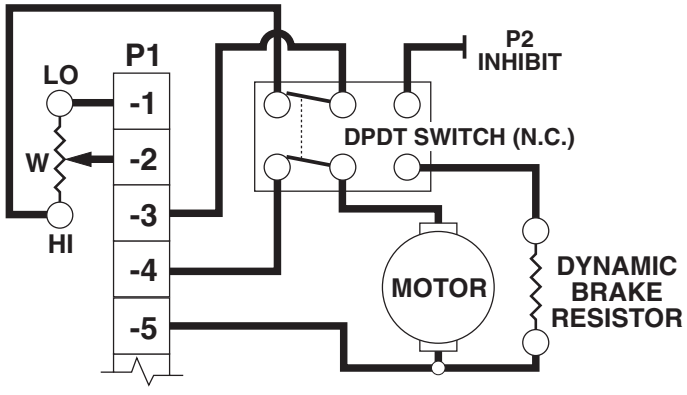
TWO SPEED OPERATION

Two pot operation is done using two 10K ohm speed potentiometers in parallel (both HI's to P1-3, both LO's to P1-1). The WIPER is switched using a SPDT switch.



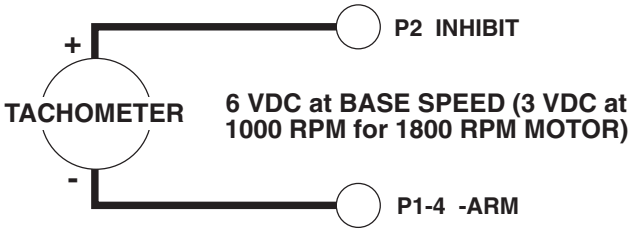
DYNAMIC BRAKING

A DPDT switch is used to inhibit the control and to connect the DBR. Typical values for the DBR (dynamic brake resistor) are 5 ohms for 120V, 10 ohms for 240V (both 35W to 50W). Note that motor horsepower, inertia, and cycle time effect sizing of the DBR.
NOTE: This modification cannot be used with the -17B option.



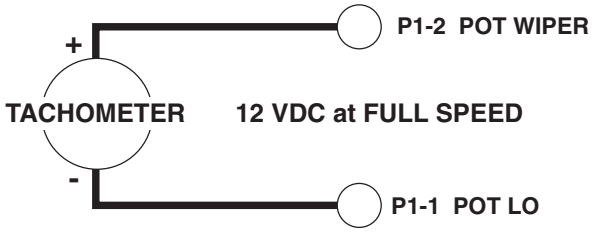
TACHOMETER FEEDBACK

Improves speed regulation to ±1/2% of base speed. Contol goes to full output when input goes to zero, above and beyond MAX trimpot setting



TACHOMETER FOLLOWER

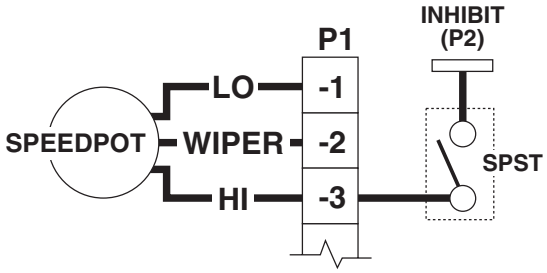
Allows control output to follow tachometer voltage.



NOTE: NEED 1% OR LESS - TACH OUTPUT RIPPLE

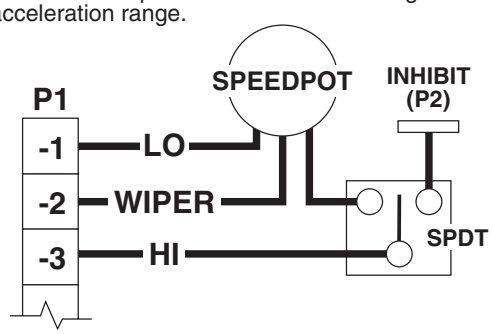
INHIBIT (USED INDEPENDENTLY)

The customer supplied SPST switch is connected in series between the speedpot HI (P1-3) and the Inhibit pin (P2). To inhibit, speedpot HI is closed to the Inhibit pin. To restart, the switch is returned to open. NOTE: The control will stop and start fast, accel is bypassed.



INHIBIT (USED WITH SPEEDPOT)

The Common of the SPDT switch is connected to control pot HI and is switched between Speedpot Hi and the Inhibit pin (P2). To inhibit (stop motor), speedpot HI is closed to the Inhibit pin. To restart, the switch is returned to Speedpot Hi. NOTE: The control will stop fast and soft start through a fixed acceleration range.



NOTE: Permits starting and stopping of motor without breaking AC lines. In the event of SCR failure or false triggering, the Inhibit circuit will not stop motor.

Always use a shielded wire when connecting to the inhibit terminal. The shield should be connected to -Armature or Common of the control.

OPTION DESCRIPTION

-5 option

Field or Factory Installed

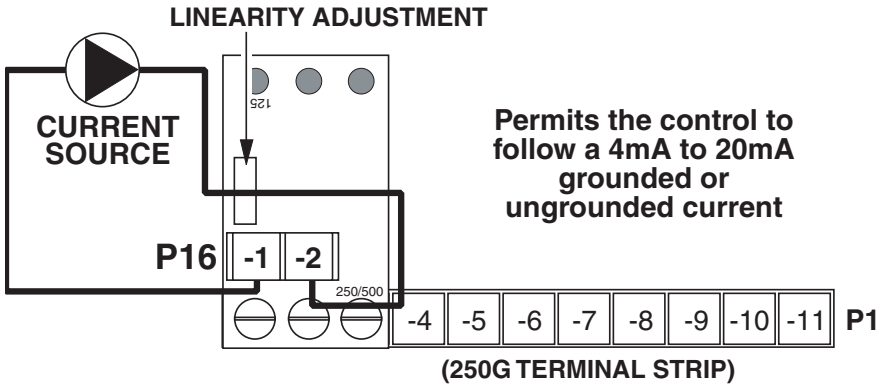
Isolated 4-20 ma.Signal Follower

Available on Chassis Only*

4 to 20mA ..... -5

Input impedance: 500 ohms or less

DO NOT USE TRIMPOT CHART TO ADJUST MIN AND MAX TRIMPOTS ON MAIN BOARD. IF ADJUSTMENT IS NEEDED THEN REFER TO THE SETUP PROCEDURE BELOW.



Permits the control to follow a 4mA to 20mA grounded or ungrounded current

(250G TERMINAL STRIP)

This option replaces the speedpot with a 4-20 ma. signal to control speed. The current signal input can be either grounded or ungrounded. The board sets on spacers screwed to terminals P1-1, P1-2, and P1-3 on the main board using long screws. The current source connects to the + and - two position terminal strip (P16-1 and -2) on the -5 option board.

The Linearity trimpot on the -5 option board is set at the factory for proper linearity, however this trimpot may need to be re-set after tuning the controls Max and Min trimpot settings for your specific application. If needed then refer to the setup procedure below.

Setting the Min, Max and Linearity Trimpots.

1. Preset the multi-turn Linearity trimpot on the –5 option board full CW, set the Min trimpot full CCW and set the Max trimpot at about 50% rotation.
2. Input a 4 ma. current signal to the control and turn the Min trimpot CW to your desired minimum output voltage or to deadband (the point just before you begin to get an output).
3. Input a 20 ma. current signal to the control and set the Max trimpot to the desired maximum speed setting.
4. With 20 ma. still going to the control, turn the Linearity trimpot CCW until your output speed starts to decrease. Then slowly turn it back CW until you just reach your maximum speed setting.

- For enclosed models use -7 option.

Note: This jumper wire is not used with some options. Consult factory if more than one option is being wired. Using the JU2 jumper wire when not required may cause permanent damage to the control.

-7 option

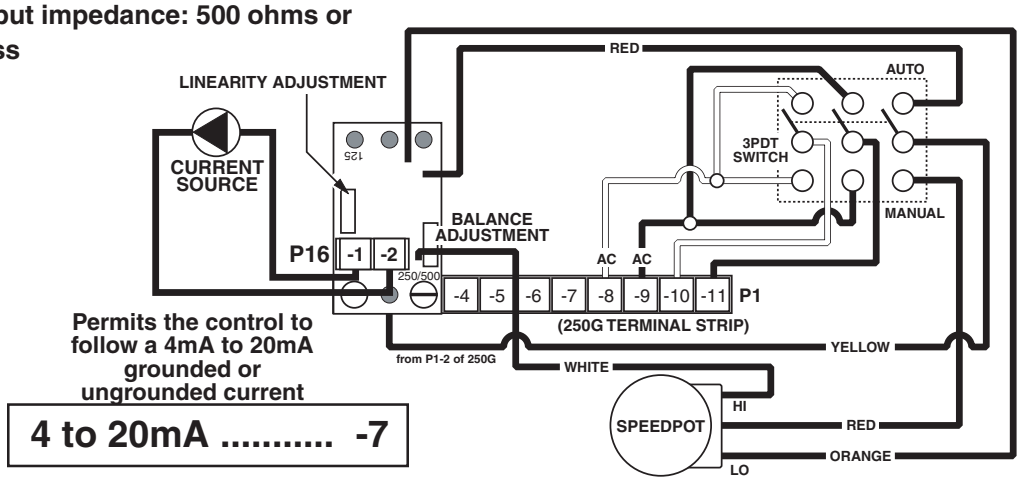
Enclosed - Factory Installed only

Isolated 4-20 ma. Signal Follower with Auto/Manual Switch

Chassis - Factory or Field Installed

Chassis - switch & wiring are customer provided

Input impedance: 500 ohms or less



DO NOT USE TRIMPOT CHART TO ADJUST MIN AND MAX TRIMPOTS ON MAIN BOARD. IF ADJUSTMENT IS NEED THEN REFER TO THE SETUP PROCEDURE BELOW.

This option allows the control to be run in either the Manual mode via a speed pot or the Auto mode via the 4-20 ma. signal. The current signal input can be either grounded or ungrounded. The board sets on spacers screwed to terminals P1-1, P1-2, and P1-3 on the main board using long screws. The current source connects to the + and - two position terminal strip (P16-1 and -2) on the -7 option board.

This option includes a Balance trimpot which is used to scale the maximum speed in the manual mode. It is factory set so the maximum speed in manual equals the maximum speed in automatic.

The Linearity trimpot on the -7 option board is set at the factory for proper linearity, however this trimpot may need to be re-set after tuning the Max and Min trimpot settings on the control or if the Balance trimpot on the –7 must be reset for your specific application. If needed then refer to the setup procedure below.

Setting the Min, Max, Balance and Linearity Trimpots.

1. Preset the multi-turn Linearity trimpot and the Balance trimpot on the –7 option board full CW, set the Min trimpot full CCW and set the Max trimpot at about 50% rotation.
2. Input a 4 ma. current signal to the control and turn the Min trimpot CW to your desired minimum output voltage or to deadband (the point just before you begin to get an output).
3. Input a 20 ma. current signal to the control and set the Max trimpot to the desired maximum speed setting.
4. Switch the control to the Manual mode setting and adjust the Balance trimpot CCW as needed to attain your required manual mode maximum output speed. (Adjustable form 50 to 100% of maximum Auto mode setting)
5. Switch the control back to Auto mode. With 20 ma. still going to the control, turn the Linearity trimpot CCW until your output speed starts to decrease. Then slowly turn it back CW until you just reach your maximum speed setting.

*** Note:** This jumper wire is not used with some options. Consult factory if more than one option is being wired. Using the JU2 jumper wire when not required may cause permanent damage to the control.

-9 option

Factory Installed Only

Special Cover Assembly

Enclosed Models Only

NEMA 4/12 enclosure kit without cover mounted on-off switch and speedpot.

-11 option
10-Turn Speedpot

Field Installed Only
Chassis Models Only

Provides finer control of speed. Use standard hook-up directions and Trimpot Chart (page 7).

-17B option
Acceleration Time Changes

Factory Installed Only
Available on all Models

Standard acceleration is variable from 0.5 to 8.0 seconds with the trimpot. The deceleration is between 0.06 and 0.8 seconds. This option extends the maximum acceleration so the range is between 0.8 and 20.0 seconds. Furthermore, this option has the deceleration time equal to the acceleration time, so deceleration range is also 0.8 to 20.0 seconds (depends on Accel setting, not an independent setting).

USE STANDARD HOOK-UP INSTRUCTIONS

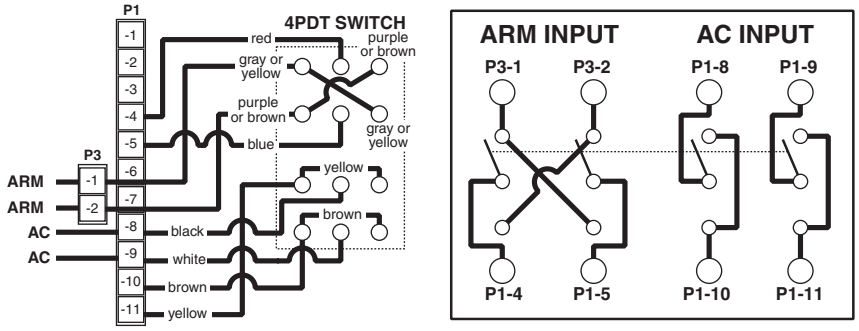
-29 and -29B options
Manual Reversing

-29 Enclosed Factory Installed Only
-29B Chassis *

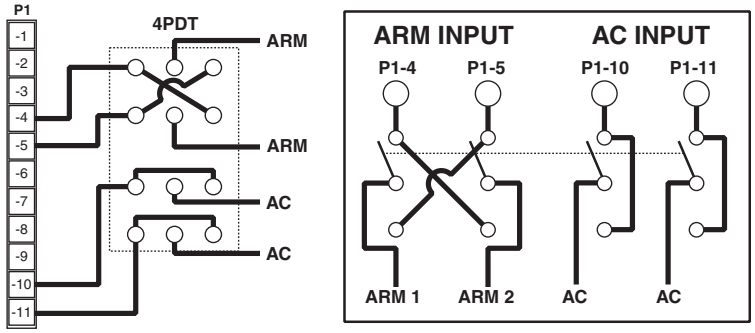
Permits reversing of motor. This is accomplished using a 4PDT blocked center switch. When switched between the forward/reverse positions, a delay is encountered due to the blocked center position, which protects the control from any voltage that may be at the armature terminals. The center position is OFF/NEUTRAL.

THE MOTOR MUST COME TO A COMPLETE STOP BEFORE CHANGING DIRECTIONS. IF THE MOTOR DOES NOT COME TO A COMPLETE STOP, SERIOUS DAMAGE TO THE CONTROL MAY RESULT. BYPASS OF THE CENTER BLOCK OF THE SWITCH MAY RESULT IN DAMAGE TO THE CONTROL.

-29 (ENCLOSED VERSION) A 4PDT blocked center-off switch is factory installed into the cover assembly. The two position terminal strip (P3) is factory installed on the main board (below). The output on P3 is the switched (FWD/REV) output and the output of terminals P1-4 and P1-5 is not switched.



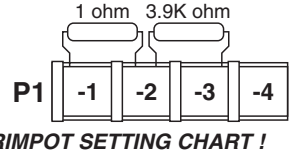
-29B (CHASSIS VERSION) * 250G control with a 4PDT switch (factory provided). The customer provides interconnecting wiring.



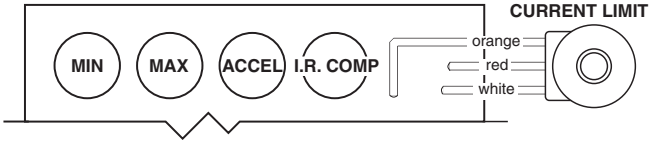
-34A option
Torque Control

Factory Installed Only
Available Enclosed Only

The TORQUE (CURRENT LIMIT TRIMPOT) is controlled by the faceplate mounted potentiometer. Thus, the internally mounted MIN trimpot becomes the Speedpot. This speedpot may be moved to a remote location by removing the fixed resistors connected on P1-1 through P1-3, and installing a standard 5K 2W potentiometer.



DO NOT USE TRIMPOT SETTING CHART !



-55G2 and -56G2 options
Isolated Voltage Input

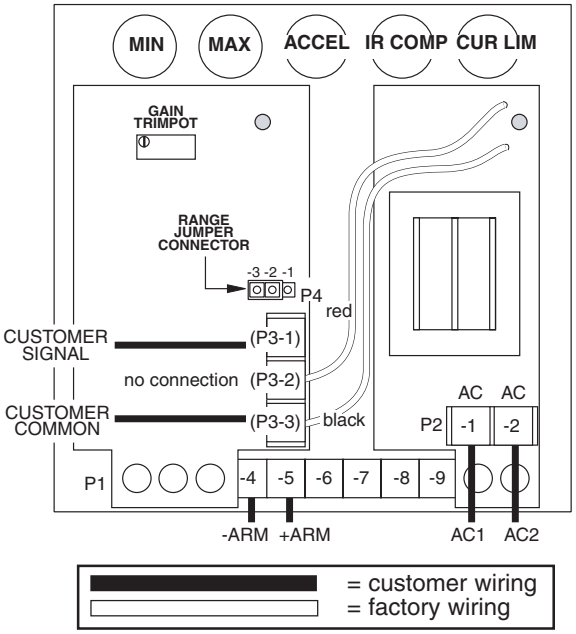
Factory or Field Installed Chassis Version

-55G2 OPTION (CHASSIS)

This option permits use of either a grounded or non-grounded remote DC voltage speed command. This DC input range, which can be selected via the range jumper clip and adjusted with the GAIN trimpot, can range from 0-5VDC through 0-25VDC (P4-2 to P4-3) or 0-25VDC through 0-250VDC (P4-1 to P4-2). The output of this option board supplies a linear signal to the control. This signal is developed from the input voltage supplied to the option board. The option is powered by the dual voltage AC input and replaces the 5K speedpot.

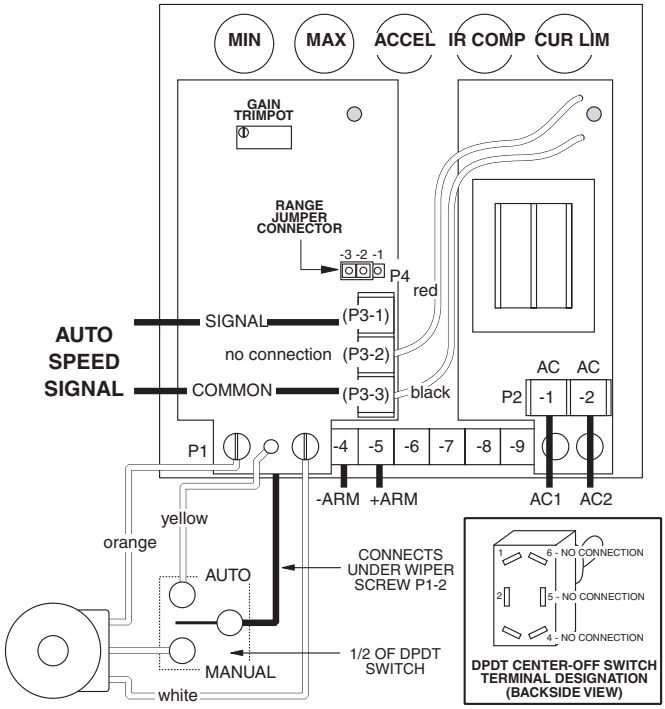
INPUT IMPEDANCE:

1.2M ohm on high scale
150K ohm on low scale



-56G2 OPTION (CHASSIS)

This is an Auto-Manual version of the -55G2 option. This option permits use of either a grounded or non-grounded remote DC voltage speed command. This DC input range, which can be selected via the range jumper clip and adjusted with the GAIN trimpot, can range from 0-5VDC through 0-25VDC (P4-2 to P4-3) or 0-25VDC through 0-250VDC (P4-1 to P4-2). The output of this option board supplies a linear signal to the control. This signal is developed from the input voltage supplied to the option board. The option is powered by the dual voltage AC input and replaces the 5K speedpot.



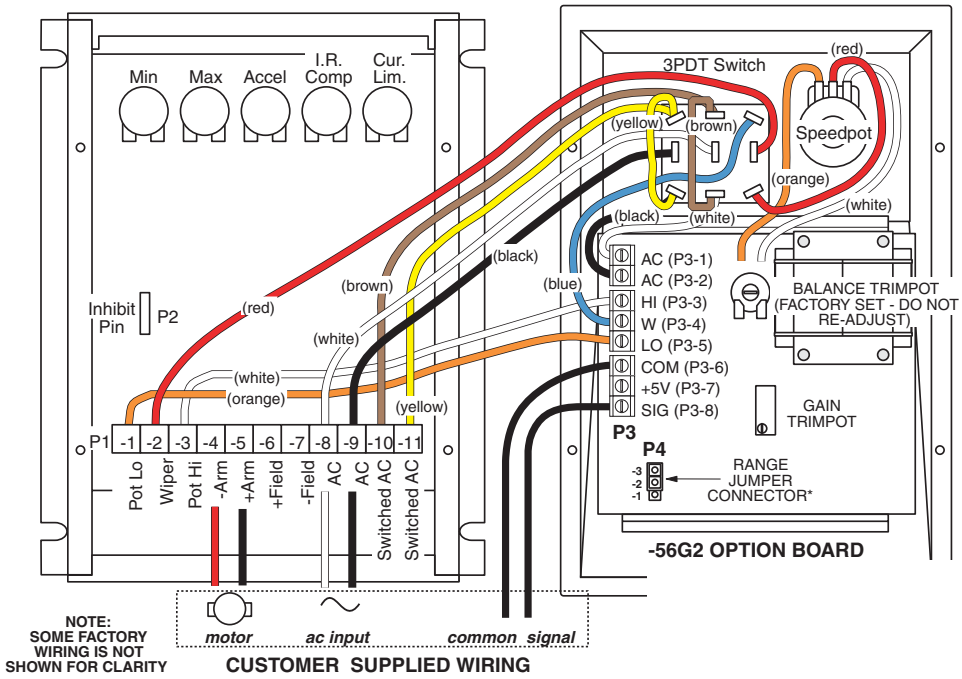
ADJUSTMENT PROCEDURE FOR -55G2 & -56G2 OPTIONS

1. With no power at the control, connect a DC voltmeter (meter must not be grounded) to control outputs as follows: **Meter COMMON to the -ARM terminal; Meter POSITIVE to the +ARM terminal**. Select correct meter range (0-90V or 0-180V).
2. Preset GAIN trimpot (option board) fully CCW, place range jumper clip in proper position.
3. Preset control as follows: MIN and I.R. COMP. fully CCW, MAX at 50%.
4. Apply desired AC voltage to control and option board.
5. With 0 volts into option board, adjust MIN trimpot on control to eliminate deadband. To do this, increase MIN fully CW, then adjust CCW until meter reads 0 volts.
6. Apply maximum input voltage to option board input.
7. Adjust GAIN until no further change in voltage output occurs and turn CCW until a 5V drop occurs, then set control MAX to 90VDC (180VDC for 240V input).
8. Set CURRENT LIMIT by using “TRIMPOT SETTING CHART” in the instruction manual.
9. For closed loop systems the I.R. COMP. should remain fully CCW. For open loop systems, set I.R. as per set-up procedure.
10. ACCEL/DECEL adjustments should be set as needed.

(continued)

-56G2 option
Isolated Voltage Input

Factory Installed Only
Enclosed Version



* Jumper clip is used to select input voltage range. When installed from P4-1 to P4-2, the range is 0-25VDC through 0-250VDC; when installed from P4-2 to P4-3, range is 0-5VDC through 0-25VDC.

See the following page for -55G2 and -56G2 Adjustment Procedures.

IN CASE OF DIFFICULTY

If a newly installed control will not operate, it is possible that a terminal or connection is loose. Check to make sure that all connections are secure and correct. If control still doesn't operate, refer to the following chart.

PROBLEM	POSSIBLE CAUSE(S)	CORRECTIVE ACTION(S)
Motor doesn't operate	- blown fuse	replace fuse
	- incorrect or no power source	install proper service
	- speedpot set at zero	adjust speedpot CW to start
	- worn motor brushes	replace motor brushes
Armature output voltage cannot be adjusted, output is a constant DC level	- no motor or load connected	check that motor or load is connected to armature terminals
	- speedpot low connection open	check that speedpot low wire is connected
Motor stalls, or runs very slowly with speedpot turned fully CW	- low voltage	check - should be above 108V
	- overload condition	reduce load
	- worn motor brushes	replace motor brushes
	- max speed set incorrectly	see ADJUSTMENT PROCEDURE
Motor hunts	- too much I.R. Comp.	see ADJUSTMENT PROCEDURE
	- motor is in current limit	see ADJUSTMENT PROCEDURE
	- motor not pulling enough current	current must be greater than 150 mA D.C.
	- max trimpot set too high	see ADJUSTMENT PROCEDURE
	- motor speed is above rated speed	reduce speed
Repeated fuse blowing	- low voltage	check - should be above 108V
	- overload condition	reduce load
	- worn motor brushes	replace
	- defective motor bearings	replace
	- defective electrical component	call Dart Distributor or Representative
Motor runs but will not stop	- incorrect wiring (enclosed version)	check TERMINAL STRIP WIRING for correct wiring instructions (note AC line connection in particular)
	- defective wiring	check wiring
	- defective component	call Dart Distributor or Representative

If control still will not operate, consult your Dart Distributor or Representative.

SPECIFICATIONS

AC input voltage ..... ±10% of rated line voltage
Acceleration ..... 0.5 to 8.0 seconds (note -17B option)
Amps - DC output ..... 150 mA to 10.8 Amps D.C.
Controller overload capacity ..... 150% for one minute
Current limit trimpot range ..... 0.3 to 3.0 Amps D.C. (251G); 1.0 to 15.0 Amps D.C. (253G)
Deceleration (dependent on acceleration time setting) ..... .06 to .80 second range
Dimensions and weight:

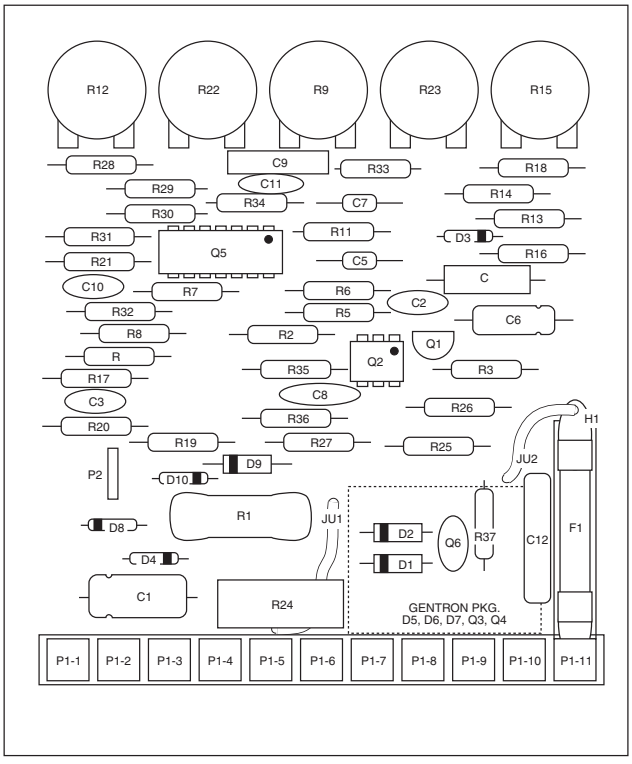
	WIDTH	LENGTH	HEIGHT	WEIGHT	TYPE
ENGLISH	5.53" 5.53"	7.25" 7.00"	3.50" 1.55"	25.50 oz. 16.25 oz.	enclosed chassis
METRIC	140mm 140mm	184mm 178mm	89mm 39mm	723 grams 413 grams	enclosed chassis

Drive service factor 1.0
Efficiency ..... 85% typical
Input frequency ..... 50 or 60 Hertz
Max. trimpot speed range ..... 66% to 110% of base speed
Min. trimpot speed range ..... 0% to 30% of maximum speed
Minimum external impedance (pot hi to pot low) ..... 5K ohms
Power devices ..... packaged full wave bridge
Shunt field voltage ..... 100VDC for 120VAC input; 200VDC for 240VAC input; 1 amp maximum
Speed control ..... via 5K ohms 2W linear potentiometer or 0-10VDC isolated signal
Speed range 50:1
Speed regulation ..... ±1% of base speed
Temperature range ..... -10° to 45° C. ambient (15° to 115° F.)
Transient protection ..... G-Mov
Type ramp of accel/decel ..... linear

TYPICAL MOTOR CURRENTS

Horsepower	1/50	1/20	1/8	1/4	1/3	1/2	3/4	1.0	1.5	2.0
Typical AC Amps (120VAC)	0.26	.70	1.80	3.50	4.40	6.50	9.30	13.20	-----	-----
Typical Arm Amps (120VAC)	0.20	.50	1.40	2.70	3.40	5.00	7.20	10.20	-----	-----
Typical AC Amps (240VAC)	-----	-----	-----	1.80	2.20	3.30	4.80	6.50	9.70	12.90
Typical Arm Amps (240VAC)	-----	-----	-----	1.40	1.70	2.50	3.70	5.00	7.50	9.90

250G SERIES PARTS PLACEMENT & LIST



NOTE: ALL RESISTORS 1/2W UNLESS SPECIFIED
* CUSTOMER WIRED SPEEDPOT

RESISTORS

R1	15K 8W	R20	1K
R2	2.7K	R21	1K
R3	2.7K	R22	50K (MAX)
R4	1.2M	R23	100Ω (I.R.)
R5	180K	R24	.01Ω 5W
R6	82K	R25	390Ω
R7	470K	R26	390Ω
R8	15K	R27	1K
R9	250K (ACCEL)	R28	20K 1/4W
R10	5K SPEEDPOT*	R29	10K
R11	10K	R30	180K
R12	5K (MIN)	R31	390K
R13	470K	R32	47K
R14	300K	R33	470K
R15	5K (C.L.)	R34	100K
R16	4.7K	R35	470Ω
R17	390K	R36	91K
R18	4.7K	R37	1Ω
R19	150K		

-17B CHANGES:
C9 .... 2.2uf 50V N.P.
R28 .. 10K

-34A CHANGES:
R10... Connect to 3 wires from R15 position
R15 .. Delete trimpot

251G-12C CHANGES:
R24 ... .1& 5W

DIODE

D1	1N4005
D2	1N4005
D3	1N914B
D4	1N5242B
D5	L512FY131
D6	L512FY131
D7	L512FY131
D8	1N914B
D9	1N4005
D10	1N5233B

ACTIVE DEVICES

Q1	2N6027
Q2	3052 MOC
Q3	L512FY131
Q4	L512FY131
Q5	LM324N IC
Q6	275V G-MOV

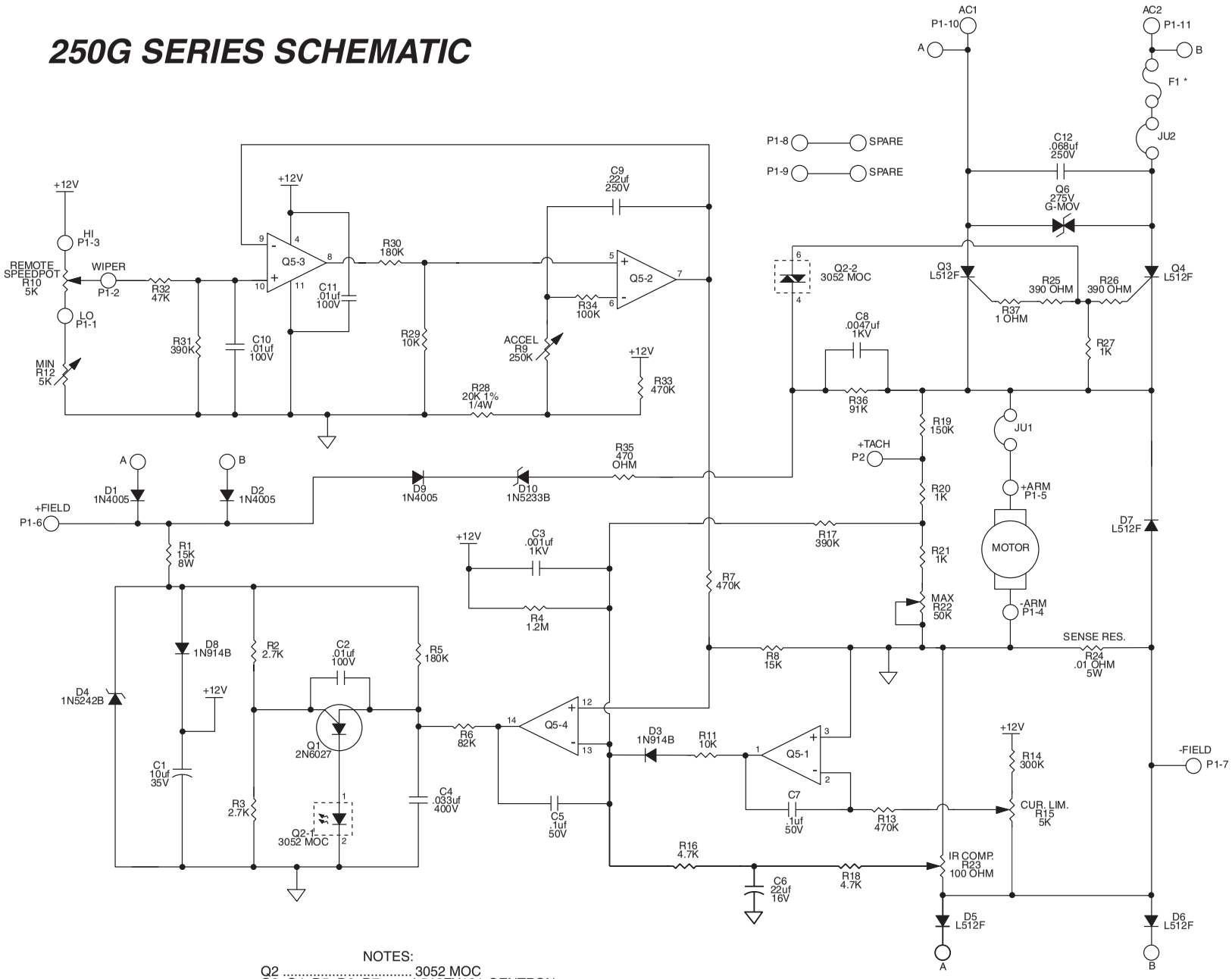
CAPACITORS

C1	10uf 35V
C2	.01uf 100V
C3	.001uf 1KV
C4	.033uf 400V
C5	.1uf 50V
C6	22uf 16V
C7	.1uf 50V
C8	.0047uf 1KV
C9	.22uf 250V
C10	.01uf 100V
C11	.01uf 100V
C12	.068uf 250V (across-the-line)

MISC. PARTS

F1	10 AMP FUSE (Bussman ABC or Little Fuse 314 Series ceramic fuses)
H1	S-8201-1X FUSE HOLDER
JU1	1.75" - 16GA. SOLID INS. WIRE
JU2	2.50" - 16GA. SOLID INS. WIRE
P1	11 POS. TERMINAL STRIP
P2	1/4" SPADE PIN TERMINAL

250G SERIES SCHEMATIC



NOTES:

Q2 ..... 3052 MOC
Q3, Q4, D5, D6, D7 ..... L512FY131 GENTRON
Q5 ..... LM324N IC
F1 * ..... BUSS ABC-10 or LITTLEFUSE 314010

ALL RESISTORS 1/2W UNLESS NOTED OTHERWISE

REPAIR PROCEDURE

In the event that a Product manufactured by Dart Controls Incorporated (DCI) is in need of repair service, it should be shipped, freight paid, to: Dart Controls, Inc., 5000 W. 106th Street, Zionsville, IN. 46077, ATTN: Repair Department.

Those orders received from anyone without and existing account with DCI will need to specify if they will be paying COD or Credit Card (Master Card or Visa). This information is required before work can begin. If you have an account with Dart your order will be processed according to the terms listed on your account.

Completed repairs are returned with a Repair Report that states the problem with the control and the possible cause. Repair orders are returned via UPS Ground unless other arrangements are made. If you have further questions regarding repair procedures, contact your Dart Controls, Inc. at 317-733-2133 Ext.460.

YOUR MOTION SYSTEMS SOLUTION PROVIDER

125D SERIES
AC INPUT - VARIABLE DC OUTPUT
1/50 HP through 1.0 HP

250G SERIES
AC INPUT - VARIABLE DC OUTPUT
1/50 HP through 2.0 HP

65 SERIES
DC INPUT - VARIABLE DC OUTPUT
CURRENT RATINGS OF 20, 40, AND 60 AMPS

700/COMMUTROL SERIES
DC BRUSHLESS
5 & 20 Amp for
12,24,& 36VDC Inputs

MDP SERIES
PROGRAMMABLE
CLOSED LOOP DC
SPEED CONTROL

DM SERIES
FIELD PROGRAMMABLE
DIGITAL TACHOMETER

Dart Controls, Inc. is a designer, manufacturer, and marketer of analog and digital electronic variable speed drives, controls, and accessories for AC, DC, and DC brushless motor applications.

Shown above is just a sampling of the expanded line of Dart controls that feature the latest in electronic technology and engineering. Products are manufactured in the U.S.A. at our Zionsville (Indianapolis, Indiana) production and headquarters facility - with over 2,000,000 variable speed units in the field.

In addition to the standard off-the-shelf products, you can select from a wide variety of options to customize controls for your specific application. For further information and application assistance, contact your local Dart sales representative, stocking distributor, or Dart Controls, Inc.

Dart Controls, Inc.

Manufacturer of high quality DC and AC motor speed controls and accessories since 1963.

P.O. Box 10
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Zionsville, Indiana 46077
Phone: (317) 733-2133
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www.dartcontrols.com

ISO9001:2000 REGISTERED

530B CONTROL SERIES

DART CONTROLS

Instruction Manual

Variable Speed DC Control

P.O. Box 10
5000 W. 106th Street
Zionsville, Indiana 46077

Phone (317) 873-5211
Fax (317) 873-1105
www.dartcontrols.com

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WARRANTY

Dart Controls, Inc. (DCI) warrants its products to be free from defects in material and workmanship. The exclusive remedy for this warranty is DCI factory replacement of any part or parts of such product which shall within 12 months after delivery to the purchaser be returned to DCI factory with all transportation charges prepaid and which DCI determines to its satisfaction to be defective. This warranty shall not extend to defects in assembly by other than DCI or to any article which has been repaired or altered by other than DCI or to any article which DCI determines has been subjected to improper use. DCI assumes no responsibility for the design characteristics of any unit or its operation in any circuit or assembly. This warranty is in lieu of all other warranties, express or implied; all other liabilities or obligations on the part of DCI, including consequential damages, are hereby expressly excluded.

NOTE: Carefully check the control for shipping damage. Report any damage to the carrier immediately. Do not attempt to operate the drive if visible damage is evident to either the circuit or to the electronic components.

All information contained in this manual is intended to be correct, however information and data in this manual are subject to change without notice. DCI makes no warranty of any kind with regard to this information or data. Further, DCI is not responsible for any omissions or errors or consequential damage caused by the user of the product. DCI reserves the right to make manufacturing changes which may not be included in this manual.

WARNING

Improper installation or operation of this control may cause injury to personnel or control failure. The control must be installed in accordance with local, state, and national safety codes. Make certain that the power supply is disconnected before attempting to service or remove any components!!! If the power disconnect point is out of sight, lock it in disconnected position and tag to prevent unexpected application of power. Only a qualified electrician or service personnel should perform any electrical troubleshooting or maintenance. At no time should circuit continuity be checked by shorting terminals with a screwdriver or other metal device.

INTRODUCTION

The 530B Series is a high performance, dual voltage versatile DC motor control which provides a wide range of standard features, with many options that extend its capabilities. The 530B Series will operate 1/8 through 1.0 horsepower at 115VAC input, and 1/4 through 2.0 horsepower at 230VAC input. A chassis only model is available to operate a 1.5 horsepower motor at 115VAC input, or 3.0 horsepower at 230VAC input. Reference “Basic Model Selection” guide.

The 530B Series consists of three basic types:

C = Chassis mounted, no enclosure, no power relay's.
RC = Chassis mounted, no enclosure, with power relay's.
RE = Plastic enclosure with power relay's - Nema 4/12 standard.

The 530B Series is designed for Permanent Magnet, Shunt Wound, and some Universal Series (AC/DC) motors in the above horsepower ranges. The 530B Series incorporates transient voltage protection with adjustable Current Limit and AC fuses for protection. Minimum and Maximum speeds are easily adjusted by trimpots, as is the I.R. Compensation. Acceleration and Deceleration are fully adjustable via individual trimpots.

COMMONLY ASKED QUESTIONS

Q. Can I run two or more motors from the same drive?
A. Not recommended. The I.R. Compensation (regulation) and Current Limit circuits would have difficulty sensing the different load on each motor.

Q. Can I change the horsepower of my motor and still use the same control?
A. Yes, provided you do not deviate outside the horsepower range for the voltage you are using. The trimpots would need readjustment; see “Trimpot Chart” for approximate settings.

Q. Can I use the 530B Series as a Current Follower?
A. Yes, there is a field installable -5 or -7 option shown in "Options" section.

Q. Can I use the 530B Series on Tachometer feedback?
A. Yes, see +Tach (P2-9) under “Terminal Strip Wiring - P2”.

Q. Can I use the Stop (P2-11), Start (P2-13), and Common (P2-12) to stop-start the control on the “C” chassis version?
A. No. Terminals P2-11, P2-12, and P2-13 are only active on the relay versions; “RE” and “RC”. These terminals are non-operative on the “C” version.

Q. Can the 530B Series be used as a Voltage or Tachometer Follower?
A. Yes. The voltage must be ungrounded and no more than +12 VDC (See “Terminal Strip Wiring” for proper hook-up).

Q. How would I proceed to stop/start the 530B Series with my own relay?
A. You can use the contact of your relay in place of the AMP REF to REV 1 (P2-2 to P2-7) jumper wire. Since this is a low level signal (12 volts at 2mA), you must use a logic type relay (preferably gold contacts). This cannot be done on controls using some options. Consult your Dart Representative if options are involved.

Q. Why is a jumper wire between AMP REF (P2-2) and REV 1 (P2-7) needed on drives with no options?
A. REV 1 (P2-7) and REV 2 (P2-8) are two identical stop inputs. One of these must be held low (to Amp Ref P2-2) for the control to run. If the drive has no options, this must be jumpered to satisfy the “OR” gate. This requirement is satisfied by some options. For these options, a connection must be made to these terminals. Instead of a jumper wire, the option is wired to these terminals. (See “Jumper Wire Selection”).

BASIC MODEL SELECTION

115/230 VAC INPUT 0-90/0-180 VDC OUTPUT 100/200 VDC FIELD

HP RANGE [1]	CHASSIS	RELAY CHASSIS	RELAY ENCLOSED
1/8 - 2.0	530BC	530BRC	530BRE

115/230 VAC INPUT 0-90/0-180 VDC OUTPUT 100/200 VDC FIELD

HP RANGE [2]	CHASSIS	RELAY CHASSIS	RELAY ENCLOSED
1.5 and 3.0	533BC	Not Available	Not Available

Notes:
1) 1/8 - 1.0 h.p. uses 115VAC input, 0-90VDC output and 100VDC field; 1/4 - 2.0 h.p. uses 230VAC input, 0-180VDC output and 200VDC field
2) 1.5 h.p. uses 115VAC input, 0-90VDC output and 100VDC field; 3.0 h.p. uses 230VAC input, 0-180VDC output and 200VDC field

CONTROL FEATURES

INPUT VOLTAGE SELECTION SWITCH - Switch **selectable** between 115 VAC and 230 VAC input.

MIN SPEED - (Minimum speed) Allows adjustment of the motor speed when the speedpot is set at minimum. This permits the user to eliminate the "Deadband" on the main speed control, permitting zero calibration. Clockwise rotation of the "MIN" trimpot increases output VDC.

ACCEL - (Acceleration) Allows adjustment of the motor acceleration from a minimum of 0.3 seconds to a maximum of 12 seconds. The -15A option extends the maximum acceleration time to 30 seconds.

DECEL - (Deceleration) Allows adjustment of the motor deceleration from a minimum of 0.6 seconds to a maximum of 12 seconds. The -15A option extends the maximum deceleration time to 30 seconds.

MAX SPEED - (Maximum speed) Allows adjustment of the motor speed when the speedpot is set at maximum (CW). This permits the user to eliminate the "DEADBAND" of the speedpot, providing full speed at maximum rotation. Rotation of the "MAX" trimpot in the clockwise direction increases maximum output VDC.

I.R. COMP - (Speed Regulation) Allows adjustment of the circuitry that controls the speed regulation of the motor. This feature controls armature speed by changing the armature voltage to compensate for increased or decreased motor loading. Clockwise rotation of the "I.R. COMP" trimpot will increase gain compensation.

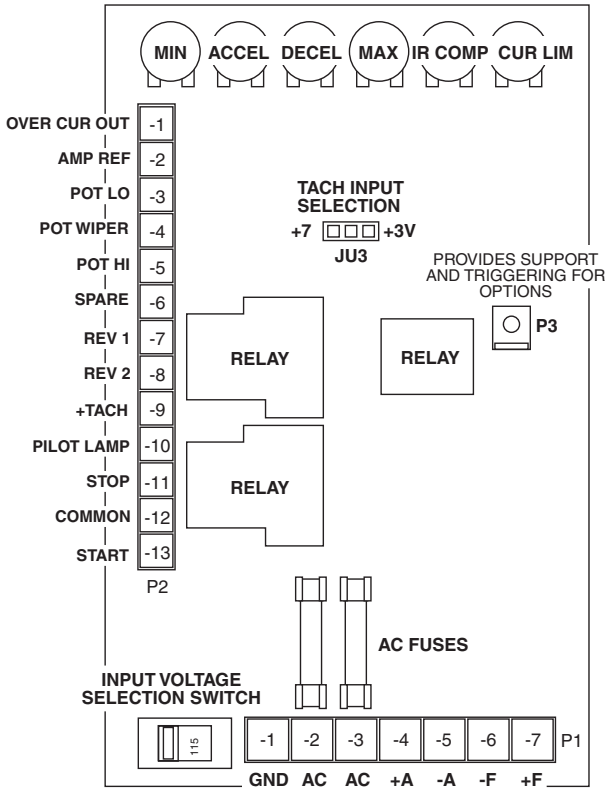
CUR. LIM. - (Current Limit) Provides protection from excessive armature current by limiting the maximum armature current the control can provide. This enables adjustment of the maximum torque the motor can deliver. Set Current Limit (CUR. LIM.) at 125% of the rated motor current. Clockwise rotation of the "CUR. LIM." trimpot increases the torque (current) the control will provide.

TACH INPUT SELECTION - Factory set at 3V per 1000 RPM, jumper selectable (JU3) to 7V per 1000 RPM. Refer to "Tach Feedback" section in "Control Modifications" for more information.

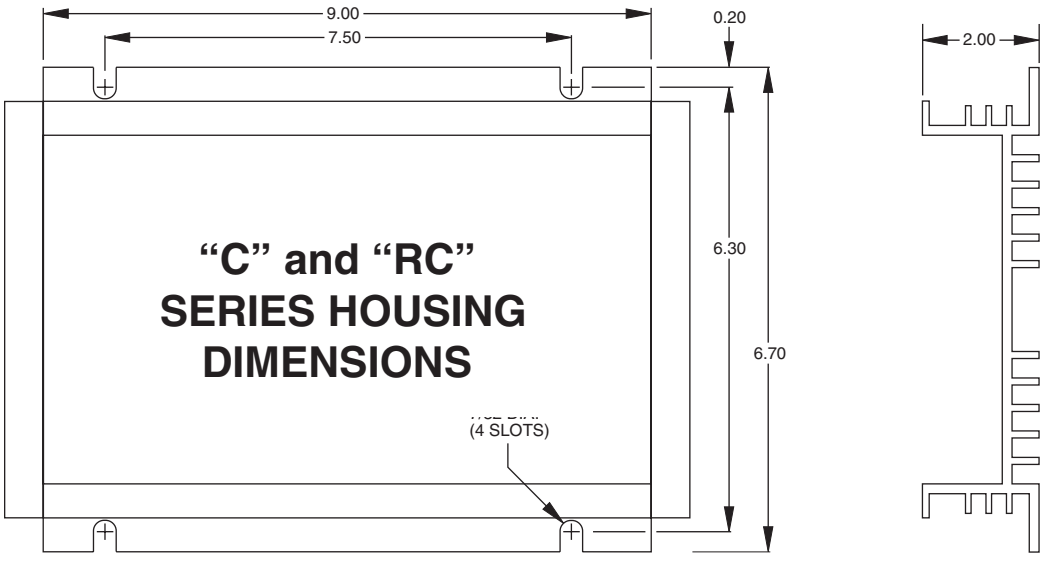
TERMINAL STRIP P1 - Barrier type terminal strip provides for connection of AC lines, motor leads, motor field (if necessary), and earth ground.

TERMINAL STRIP P2 - Barrier type terminal strip provides for connection of speed potentiometer and any accessories and/or jumper wires which control the drive.

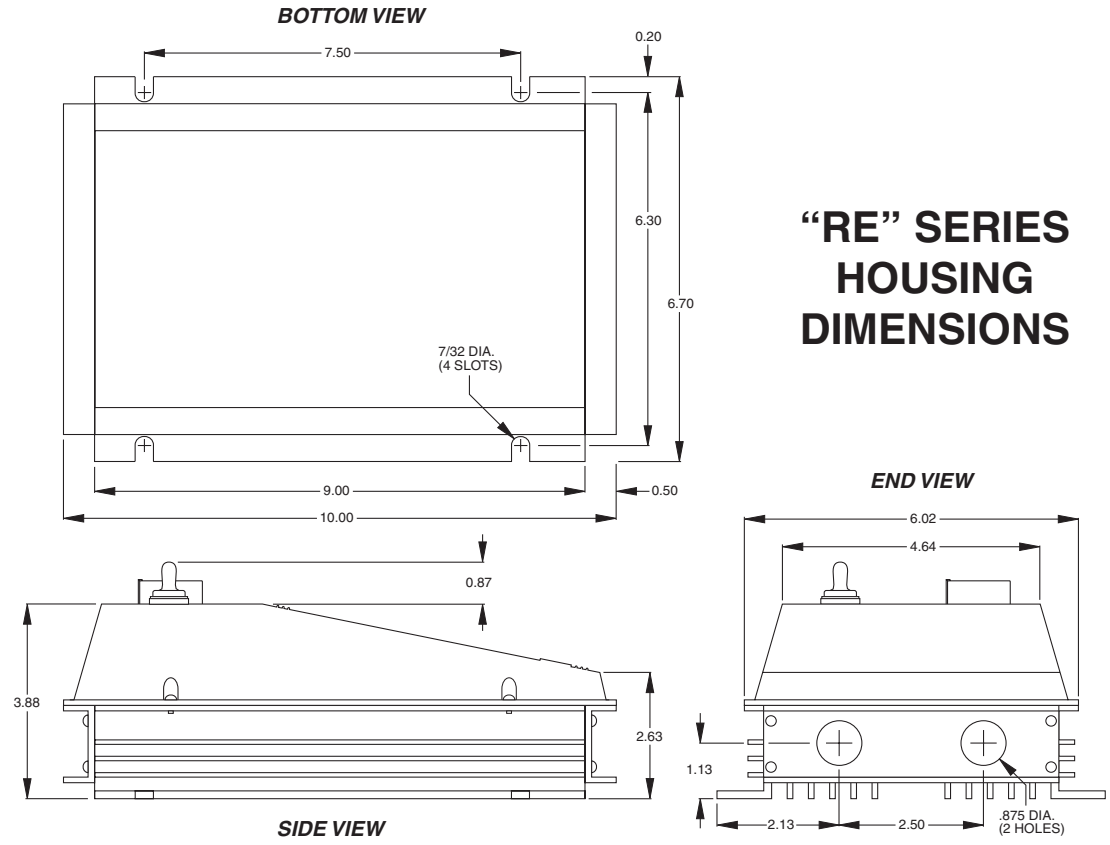
RELAY - (Power Interrupt Relay's) Available only on the "RC" and the "RE" versions, the relay's permits the switching of AC power with a low current signal. For the "RE" version, the relay's will not allow start up after power failure without manually restarting.



OVERALL CONTROL DIMENSIONS



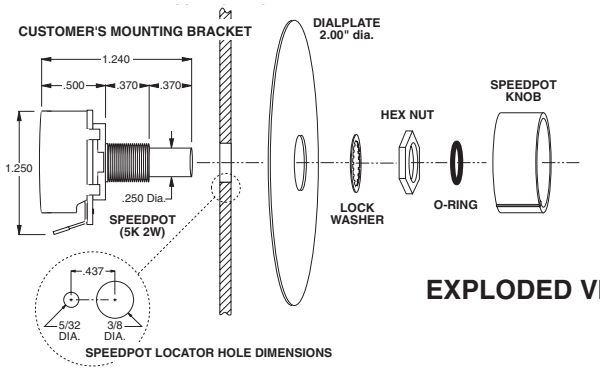
(Control dimensions continued)



"RE" SERIES HOUSING DIMENSIONS

SPEEDPOT MOUNTING DIMENSIONS

(For "C" and "RC" versions)



EXPLODED VIEW

DO NOT MOUNT CONTROL WHERE AMBIENT TEMPERATURE IS OUTSIDE RANGE OF -10° to 45° C. (15° to 115° F.)

MOUNTING INSTRUCTIONS

1. Four 7/32" slots are provided for control mounting.
2. The 530B Series chassis can be used as a template.
3. Use standard hardware to mount.
4. For the "RE" version ONLY: Two 7/8" diameter holes are provided in one endplate to facilitate wiring. This allows for easy connection of 1/2" conduit.

NOTE: For enclosed models using 1 h.p. 90V or 2 h.p. 180V motors, the control MUST be mounted vertically.

CAUTION:

DO NOT ATTEMPT TO PERFORM HI-POT TEST ACROSS AC LINES WITH THE CONTROL IN CIRCUIT. THIS WILL RESULT IN IMMEDIATE OR LONG TERM DAMAGE TO THE CONTROL.

WIRING PROCEDURE

1. Size all wires which carry armature or line current to handle currents AS SPECIFIED BY NATIONAL, STATE, AND/OR LOCAL CODES. All other wires may be # 20AWG or smaller as permitted by local code.
2. Control wire (Pot, Tach, etc.) should be separated from all the Armature, Field (if Shunt Wound), and the AC wires when routed in conduits or in wire trays. The enclosed version has two holes on one endplate for this purpose.

TERMINAL STRIP WIRING - P1

CAUTION: BE SURE CONTROL HOUSING IS PROPERLY GROUNDED.

The 530B Series uses a 7 position barrier type terminal strip to handle the power connections.

P1-1 **(EARTH GROUND)** - Ground the control by connecting the ground wire to this terminal. NOTE: Terminals P1-5 (-ARM) and P2-2 (AMP REF) are electrically the same, which is the common reference point (low voltage common) for the control logic. The EARTH GROUND terminal (P1-1) is electrically different from common. If connected together, either at the amplifier or in any other fashion, fatal or hazardous operation may occur and permanent damage to the control WILL result!

P1-2 **(AC1) 115VAC** - Connect incoming hot AC (black wire) to this terminal. NOTE: This is fused (F1) on the control.
(AC1) 230VAC - Connect either hot side.

P1-3 **(AC2) 115VAC** - Connect the neutral AC (white wire) to this terminal. NOTE: This is fused (F2) on the control.
(AC2) 230VAC - Connect either hot side.

P1-4 **(+ ARMATURE)** - Connects to the plus (+) Armature wire on the motor. 0-90VDC for 115VAC input or 0-180VDC for 230 VAC input. See "SPECIFICATIONS" for output rating.

CAUTION: ARMATURE CONNECTION MUST NOT BE SWITCHED OR BROKEN WHILE CONTROL IS ON OR SERIOUS DAMAGE TO THE CONTROL MAY RESULT.

P1-5 **(- ARMATURE)** - Connects to minus (-) Armature wire (also considered circuit common) on the motor.

P1-6 **(- FIELD) -** Connect minus (-) Field wire of the Shunt Wound motor (not used on PM motors).

FIELD VOLTAGE TABLE		
Model #	**VAC Input**	**VDC Field**
530B Series	115	100
	230	200

P1-7 **(+ FIELD)** - DO NOT use for Permanent Magnet motor. This supplies + Field voltage for a Shunt Wound motor. See chart above for dual voltage Field Wound motors. This output is rated at 1 Amp for 530B series controls and 1.5 Amps for the 533B control. For motors with dual voltage field (ie. 50/100V or 100/200V), make sure the highest value is connected.

TERMINAL STRIP WIRING - P2

The 530B Series uses a 13 position barrier type terminal strip for control connections.

CAUTION: NONE OF THE P2 TERMINALS SHOULD BE EARTH GROUNDED!

P2-1 **(OVER CURRENT OUT)** - Can be used to signal that the control is in current limit. It can also signal other devices or alarms. This is a low level logic signal which goes "high" when the current limit amplifier is in current limit. The logic of this control is +12 volts, while the output at this terminal is approximately 1.5 volts through a 1000Ω resistor when in Current Limit.

P2-2 **(AMP REF)** - This is the common point of the logic. It is used as common with OVER CURRENT OUT (P2-1), +TACH (P2-9), REV 1 (P2-7), REV 2 (P2-8), and WIPER (P2-4). NOTE: Never connect this terminal to earth ground !! Serious damage and injury may result !! This terminal is electrically the same point as -ARM (P1-5).

P2-3 **(SPEEDPOT LO)** - Connects to the low side (orange wire) of the 5K Speedpot (normally the CCW end). This input is raised and lowered by the MIN trimpot. Electronic speed input voltage (voltage follower) may be referenced to Speedpot LO if the MIN trimpot adjustments are to be active. Otherwise, inputs may be referenced to AMP REF (P2-2), which will bypass the MIN trimpot. INPUT MUST NOT BE GROUNDED !

**CAUTION FOR VOLTAGE FOLLOWER APPLICATIONS:
THE INPUT CONNECTION TO THE SPEEDPOT MUST NOT BE GROUNDED !!
SERIOUS DAMAGE TO THE CONTROL MAY RESULT FROM A GROUNDED INPUT.**

P2-4 **(SPEEDPOT WIPER)** - Connects to the wiper (red wire) of the Speedpot (center lead). Use this input for the plus (+) side of voltage follower operation or tach follower. The minus (-) side connects to AMP REF (P2-2). INPUT MUST NOT BE GREATER THAN +12V MAXIMUM AND MUST NOT BE GROUNDED !

P2-5 **(SPEEDPOT HI)** - Connects to high side (white wire) of the Speedpot (CW end). This is internal +12 volts. INPUT MUST NOT BE GROUNDED !

P2-6 **(SPARE) -** This terminal is not connected to the control circuit. It can be used as a terminal for field modifications.

(P2 wiring continued)

(P2 wiring continued)

P2-7 **(REV 1)** - REV 1 and REV 2 are identical quick stop inputs. One of them must be held low (to AMP REF) before the control will operate. The two are diode separated to form an “OR” gate. Since -ARM (P1-5) is also low in the system, these two inputs can be wired to the motor side of a reversing switch or relay. During the period of switching, neither input will be low, which will instantly return the set speed to zero and reset the acceleration ramp.

P2-8 **(REV 2)** - Identical to REV 1 (P2-7).

P2-9 **(+TACH) -** Connect +Tach from a DC tachometer for tachometer feedback. The minus (-) lead from the tachometer goes to AMP REF (P2-2). Output voltage from the tachometer at full speed can range from 6 to 12 volts. The scale is corrected using the JU3 jumper selectable setting of 3V/7V per 1000 RPM and the MAX speed trimpot. A 3 volt per 1000 RPM OR 7 volt per 1000 RPM tachometer should be used.

P2-10 **(PILOT LIGHT)** - Connecting point for on-off neon indicator lamp. The remaining lead will be connected to P2-11.

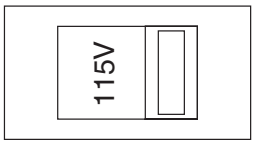
P2-11 **(STOP) -** Install one or more normally closed stop switches (in series) between STOP (P2-11) and COMMON (P2-12). Not active on “C” version.

P2-12 **(COMMON)** - Mid point of Start-Stop switches. Not active on “C” version.

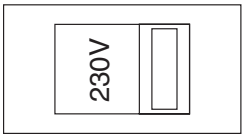
P2-13 **(START) -** Install one or more normally open start switches (in parallel) between START (P2-13) and COMMON (P2-12). Not active on “C” version.

SETTING INPUT VAC

For use with 110 through 130 VAC inputs, slide 115/230 VAC input voltage selector switch completely to the left as shown below left. For use with 208 through 240 VAC inputs, slide the same selector switch completely to the right as shown below right.

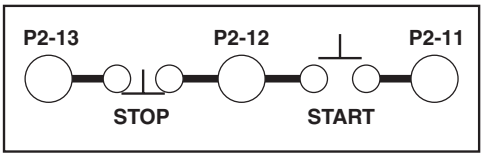


Note:
An incorrect setting of the input VAC selector switch will result in damage to the controller.

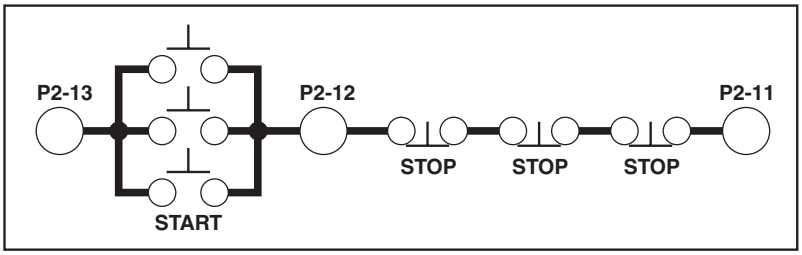


SWITCH LADDER CIRCUIT DIAGRAMS

START-STOP WIRING

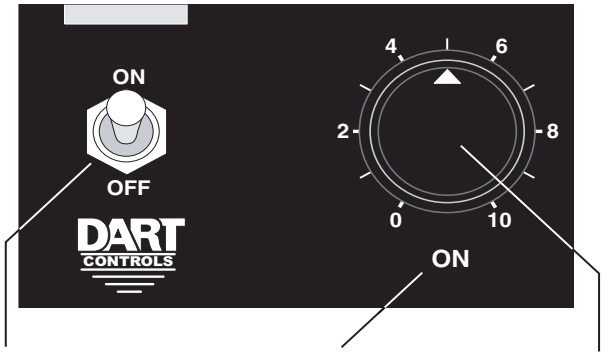


START-STOP WIRING (WITH 3 STATIONS)



Warning:
This diagram is for "RC" and "RE" versions ONLY! DO NOT use on "C" version.

“RE” CONTROL PANEL IDENTIFICATION



START-STOP SWITCH
MOMENTARY SWITCH TURNS CONTROL ON AND OFF

POWER ON INDICATOR
HIDDEN LED INDICATOR LAMP

SPEED POTENTIOMETER
5000& 2W SPEEDPOT CONTROLS MOTOR SPEED

INITIAL START UP

1. **Check** to see that **the 115/230 VAC selection switch is set for the desired input voltage**.
2. Recheck all wiring. Accidental grounds, loose or pinched wires on armature or speed potentiometer wires may damage the control when power is applied.
3. See “ADJUSTMENT PROCEDURE” and observe the WARNINGS pertaining to cover removal for adjustments.
4. Preset trimpots for your horsepower by using the “TRIMPOT CHART”. NOTE: Options may change the trimpot setting from this chart. If your control has an option, be sure to carefully read the section in “OPTIONS” that pertains to your option.
5. Turn speed potentiometer to zero (fully CCW).
6. Turn power on and advance speedpot while observing motor.
7. If motor rotation is incorrect, turn power off at external disconnect and reverse the +ARM and -ARM connections.
8. If operation is satisfactory, no re-adjustments are needed.
9. If instability or surging is observed, or if maximum speed is higher than desired, proceed to “ADJUSTMENT PROCEDURE”.
10. For other problems, see section “IN CASE OF DIFFICULTY”.

WARNING:
WHEN MAKING AN ADJUSTMENT, ALWAYS USE A SCREWDRIVER WITH AN INSULATED SHAFT TO AVOID THE SHORT CIRCUITING OF PC BOARD COMPONENTS. WHENEVER THE CONTROL COVER IS REMOVED, IT MUST BE SUPPORTED TO AVOID ACCIDENTAL CONTACT BETWEEN CONTROL CHASSIS AND LIVE COVER COMPONENTS.

TRIMPOT ADJUSTMENT PROCEDURE

Four adjustments (MIN., MAX., I.R. COMP., and CUR. LIM.) are checked at the factory using a typical motor. Use the “TRIMPOT CHART” to adjust the trimpots to the approximate setting for your horsepower. The other two adjustments (ACCEL and DECEL), are the Acceleration and Deceleration adjustments and should be set for your particular application requirements. The “TRIMPOT CHART” is approximate and is valid when using a speedpot or a 0 to 12VDC input signal to control the speed. Operation of the control beyond ±10% of normal line voltage is not recommended and could result in readjustments. These settings are permanent; periodic readjustment is normally not needed. (NOTE: Use only an ungrounded voltmeter).

MAX. **Sets maximum motor speed when speedpot is at 100% CW rotation. Clockwise rotation increases maximum motor speed.**

1) Turn drive power OFF!
2) Connect a DC voltmeter; plus to +ARM and minus to -ARM.
3) Set meter voltage range for either 90 VDC or 180 VDC.
4) With no load on the motor, adjust the MAX trimpot to the rated armature voltage as seen on the meter.

NOTE: A tachometer or strobe may be used in place of a meter. Follow the above steps, but adjust the MAX trimpot to the rated motor base speed, indicated by tach or strobe.

MIN. **Sets minimum motor voltage when Speedpot is set at zero. Clockwise rotation of the MIN. trimpot will increase the minimum motor voltage.**

1) Set Speedpot to zero (fully CCW).
2) With no load on the motor, adjust the MIN trimpot clockwise until the motor starts to rotate.
3) Slowly back off the trimpot in the CCW direction until the motor stops.

NOTE: If motor rotation is desired at zero Speedpot setting, adjust the MIN trimpot clockwise until the desired minimum speed is reached.

I.R. COMP. **Provides a means of improving speed regulation in the armature feedback mode. If a change in motor speed during a load change is of no concern, rotate this trimpot fully CCW.**

1) Set speedpot at 50%.
2) Observe motor speed during a no load condition.
3) Apply a full load to the motor.
4) Adjust the I.R. COMP. trimpot clockwise (while the load is applied) until the no load motor speed is obtained.

(Adjustment procedure continued)

CUR. LIM. **Limits DC motor armature current (torque) to prevent damage to the motor or control. The current limit is set for 125% of the rated motor current. Clockwise rotation of this trimpot increases the armature current (or torque produced).**

1) Turn drive power OFF!
2) Connect a DC Ammeter in series with the +ARM line (between +A on motor and +ARM on the control). Preset the current limit trimpot CCW.
3) Turn power on and set speedpot to 50%.
4) Increase the motor load until the motor stalls (zero RPM).
5) Set CUR. LIM. trimpot by adjusting CW to 125% of the rated motor armature current (see “TRIMPOT CHART”).

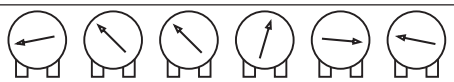
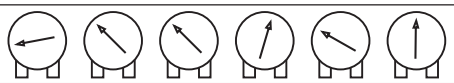
ACCEL **Allows adjustment of acceleration by user.**

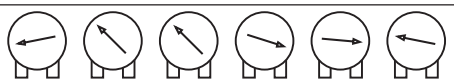
1) Clockwise trimpot rotation increases length of acceleration time needed for the control to reach full speed.

DECEL **Allows adjustment of deceleration by user.**

1) Clockwise trimpot rotation increases length of deceleration time needed for the control to reach zero speed.

TRIMPOT SETTING CHART

MIN	ACCEL	DECEL	MAX	I.R.	CUR LIM	HP	VOLTS
						1/8	115
						1/6	115
						1/4	115
						1/3	115
						1/2	115
						3/4	115
						1.0	115
						1.5	115

MIN	ACCEL	DECEL	MAX	I.R.	CUR LIM	HP	VOLTS
						1/4	230
						1/3	230
						1/2	230
						3/4	230
						1.0	230
						1.5	230
						2.0	230
						3.0	230

NOTES: These settings apply when using a 5000Ω speedpot. This chart cannot be used with certain Options (refer to Option section)

1.5 and 3.0 HORSEPOWER - MODEL 533BC

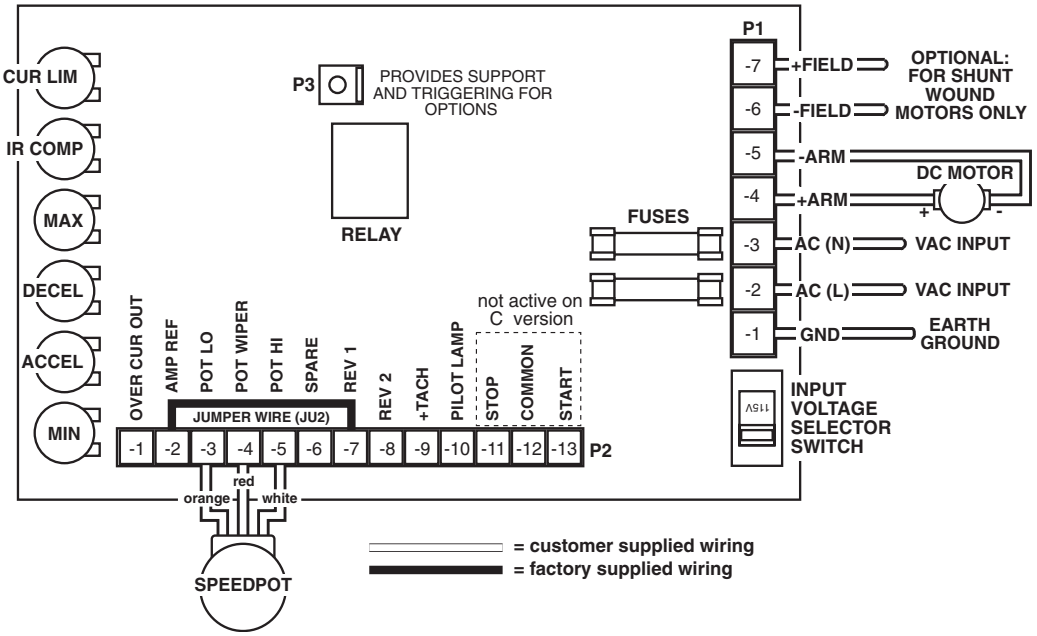
For 1.5 and 3.0 horsepower applications, the model 533BC control has the following restrictions:

- Available in chassis (C) mount only.
- The 1.5 horsepower model is available in 115 VAC input at 0-90 VDC out, while the 3.0 horsepower model is available in 230 VAC input at 0-180 VDC out.
- Relay, start-stop, reversing, dynamic braking & jogging are not available from factory (they are customer supplied and wired).
- The isolation boards (-5 and -7 options) are available.

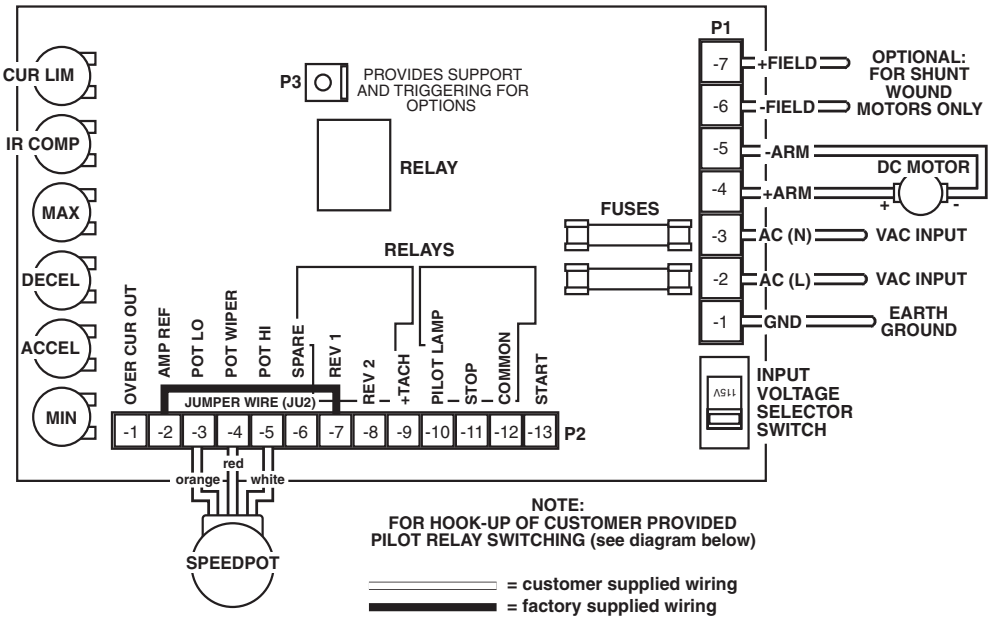
BASIC HOOK-UP DIAGRAMS WITHOUT OPTIONS

(If options are included on your control, see the option section of this manual).

Model 530BC and 533BC ("C Version")



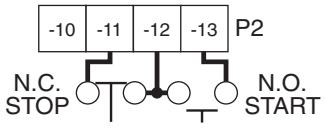
Model 530BRC ("RC Version")



PILOT RELAY SWITCHING

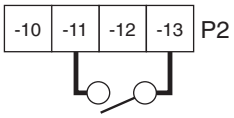
(Customer supplied wiring for the “530BRC” version)

MOMENTARY ON-OFF SWITCH(ES)



After loss of incoming AC power, unit will not restart until start switch is closed.

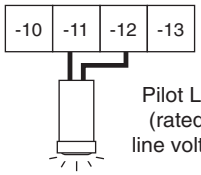
SPST SWITCH*



Unit will self-start when switch is closed.

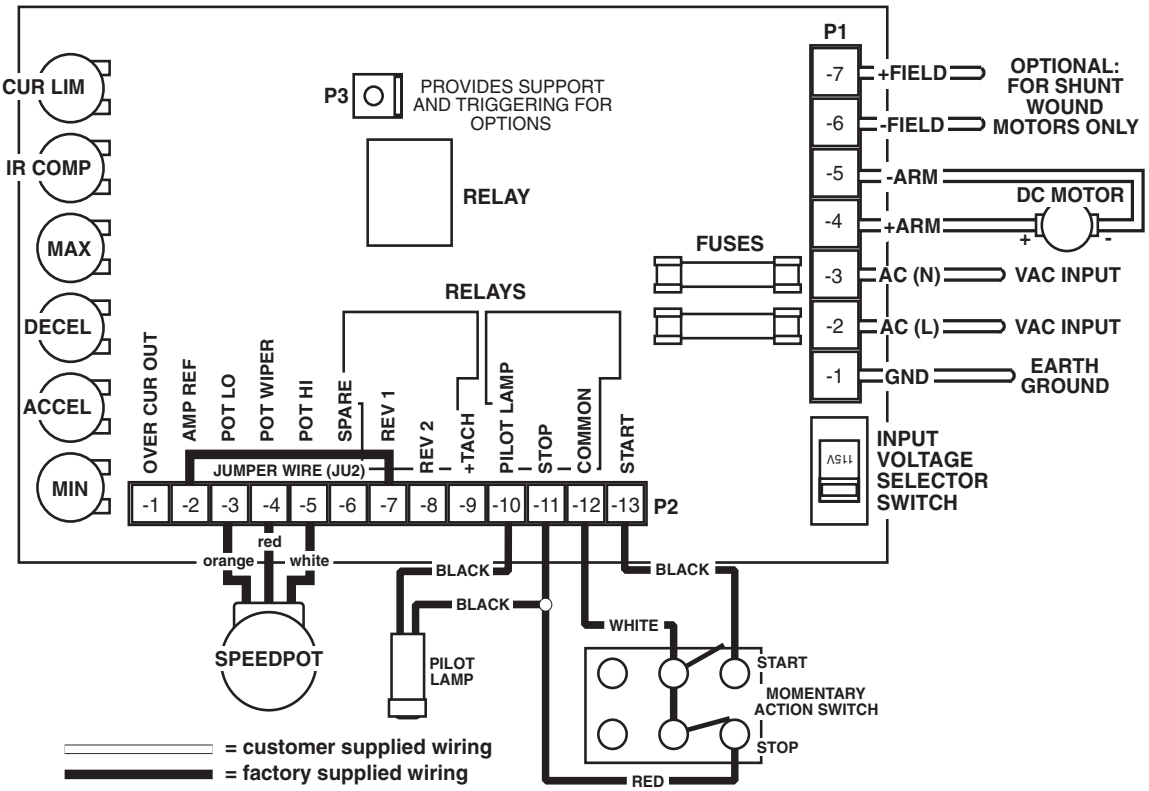
A jumper wire may be used in place of the SPST switch. If wired with a jumper, the control will always be on whenever AC input voltage is applied.

OPTIONAL PILOT LAMP



Pilot Lamp (rated for line voltage).

Model 530BRE ("RE Version")



JU2 JUMPER WIRE SELECTION CHART

NOTE: Jumper wires may be required on terminal strip P2 for the control to operate (refer to jumper chart below).

As explained in the "COMMONLY ASKED QUESTIONS" section, REV 1 (P2-7) and REV 2 (P2-8) are both stop inputs. One of these inputs must be held low to AMP REF (P2-2) for the control to operate. Jumpering is necessary between AMP REF and REV 1 or REV 2 to satisfy the "OR" gate. An option board may be installed on the control satisfying the "OR" gate. This jumper (between P2-2 and P2-7) is called JU2. For inhibiting with soft start and fast stop, the JU2 jumper may be replaced by a SPST switch.

YES = JUMPER REQUIRED NO = JUMPER NOT USED

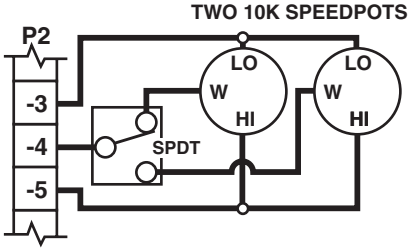
OPTION	DESCRIPTION	PAGE #	JUMPER	"C"	"RC"	"RE"
NONE	STOCK CONTROL	9-10	JU2	YES	YES	YES
-4	JOG	11	JU2	YES	YES	YES
-5/-7	CURRENT FOLLOWER	12-13	JU2	YES	YES	YES
-36M/-38M	FWD / REV with ZERO SPEED and D.B.R.	14-15	JU2	NO	NO	NO

NOTE: Installing JU2 jumper when not required may cause permanent damage to control.

CONTROL MODIFICATIONS

TWO SPEED OPERATION

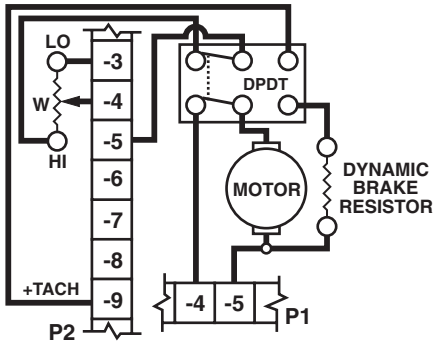
Two pot operation is done using two 10KΩ speed potentiometers in parallel (both HI's to P2-5, both LO's to P2-3). The WIPER is switched using a SPDT switch.



DYNAMIC BRAKING

A DPDT switch is used to inhibit the control and to connect the DBR. Typical values for the DBR (dynamic brake resistor) are 5 for 115V, 10 for 230V (both 35Ω to 50Ω). Note that motor horsepower, inertia, and cycle time effect sizing of the DBR.

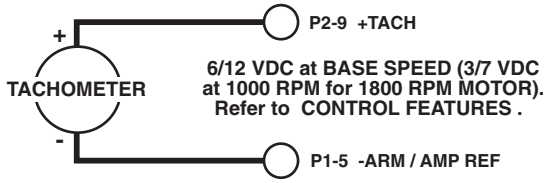
NOTE: On -15A Option, Decel must be fully CCW to use with DBR.



(Continued on following page)

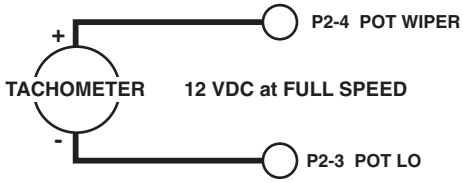
TACHOMETER FEEDBACK

Improves speed regulation to –1/2% of base speed.



TACHOMETER FOLLOWER

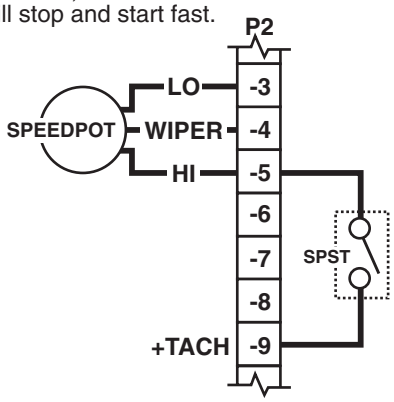
Allows control output to follow tachometer voltage.



NOTE: NEED 1% OR LESS - TACH OUTPUT RIPPLE

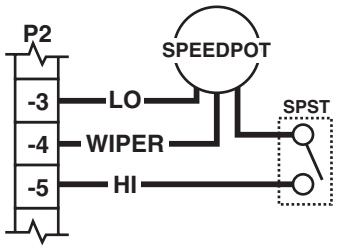
INHIBIT (USED INDEPENDENTLY)

The customer supplied SPST switch is connected in series between the speedpot HI (P2-5) and the +TACH terminal (P2-9). To inhibit, speedpot HI is closed to the +TACH terminal. To restart, the switch is returned to open. NOTE: The control will stop and start fast.



INHIBIT (USED WITH SPEEDPOT)

The customer supplied SPST switch is connected in series between the speedpot HI terminal (P2-5) and speedpot HI. To inhibit, the SPST switch contacts are opened. To restart, the switch is returned to the closed position. NOTE: The control will soft stop and soft start through the acceleration setting.



NOTE: Permits starting and stopping of motor without breaking AC lines. In the event of SCR failure or false triggering, the Inhibit circuit will not stop motor.

Always use a shielded wire when connecting to the inhibit terminal. The shield should be connected to the -Armature or Common of the control.

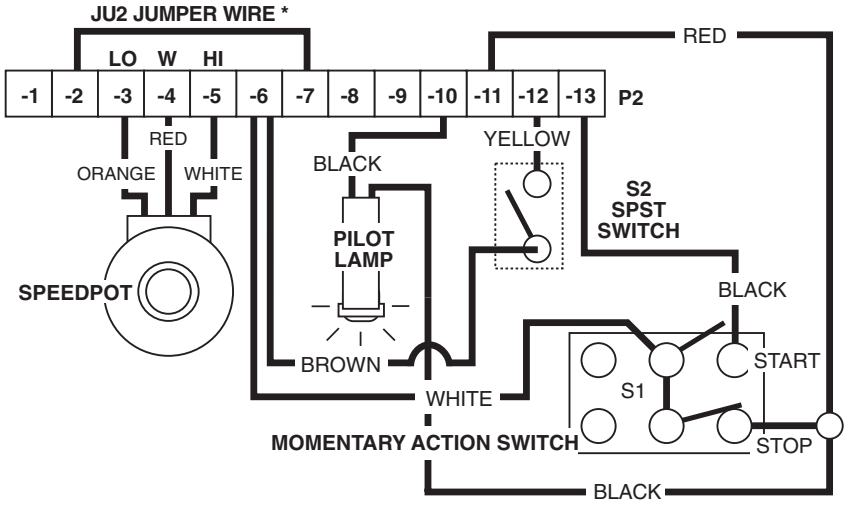
OPTIONS

NOTE: All options are specified by a suffix to the model number. This suffix starts with a dash (-). The more popular options are described on the following pages. When a combination of two or more of these options are used, the wiring procedure is beyond the scope of this manual. Please contact your Distributor or Representative.

-4 Option — *See below for installation and availability*

Jog

This option is factory installed on the "RE" version only. "S2" is located on the cover and disables the latch circuit of the power relay's, allowing the power switch to jog the drive. The "C" and "RC" versions use customer supplied switch and wiring, in addition the "C" version uses a customer supplied relay.



NOTES:

For "RE" version, S1, S2 and pilot lamp are FACTORY PROVIDED.

For "C" and "RC" versions, S1, S2, and pilot lamp are CUSTOMER PROVIDED.

*** This jumper wire is not used with some other options. Consult factory if more than one option is being wired. Using JU2 jumper when not required may cause permanent damge to the control.**

-5 Option

Isolated 4-20 ma.Signal Follower

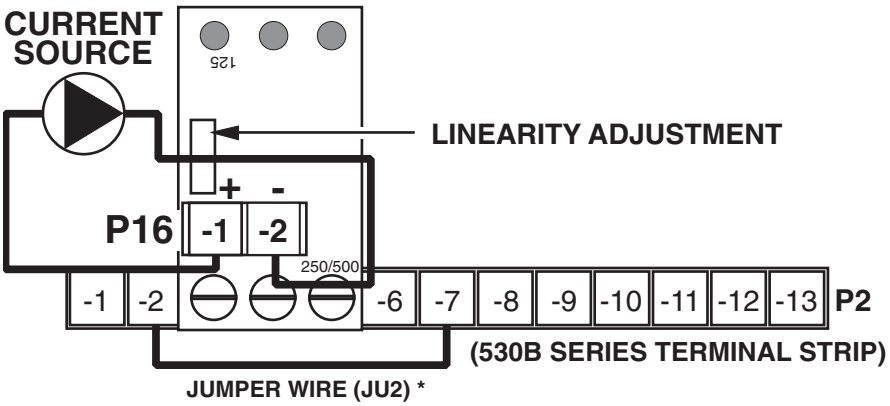
Available on "C" and "RC" models only*

Factory or Field installed

4 to 20 mA ..... -5

Input impedance: 500 ohms or less

DO NOT USE <u>TRIMPOT CHART</u> TO ADJUST MIN AND MAX TRIMPOTS ON MAIN BOARD. IF ADJUSTMENT IS NEEDED THEN REFER TO THE SETUP PROCEDURE BELOW.



This option replaces the speedpot with a 4-20 ma. signal to control speed. The current signal input can be either grounded or ungrounded. The board sets on spacers screwed to terminals P1-3, P1-4, and P1-5 on the main board using long screws. The current source connects to the + and - two position terminal strip (P16-1 and -2) on the -5 option board.

The Linearity trimpot on the -5 option board is set at the factory for proper linearity, however this trimpot may need to be re-set after tuning the controls Max and Min trimpot settings for your specific application. If needed then refer to the setup procedure below.

Setting the Min, Max and Linearity Trimpots.

1. Preset the multi-turn Linearity trimpot on the –5 option board full CW, set the Min trimpot full CCW and set the Max trimpot at about 50% rotation.
2. Input a 4 ma. current signal to the control and turn the Min trimpot CW to your desired minimum output voltage or to deadband (the point just before you begin to get an output).
3. Input a 20 ma. current signal to the control and set the Max trimpot to the desired maximum speed setting.
4. With 20 ma. still going to the control, turn the Linearity trimpot CCW until your output speed starts to decrease. Then slowly turn it back CW until you just reach your maximum speed setting.

For enclosed models use -7 option.

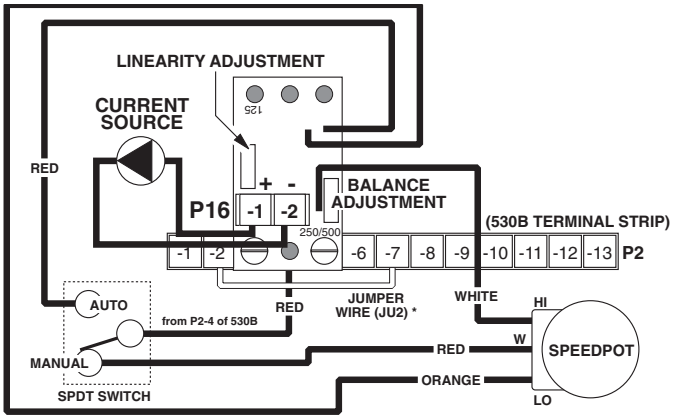
*** Note:** This jumper wire is not used with some options. Consult factory if more than one option is being wired. Using the JU2 jumper wire when not required may cause permanent damage to the control.

-7 Option
Isolated 4-20 ma. Signal Follower
with Auto / Manual Switch

Factory or Field installed Chassis unit
Factory only on Enclosed models
Available on all models

Input impedance equals 500Ω or less

4 to 20 mA ..... -7



DO NOT USE TRIMPOT CHART TO ADJUST MIN AND MAX TRIMPOTS ON MAIN BOARD. IF ADJUSTMENT IS NEED THEN REFER TO THE SETUP PROCEDURE BELOW.

This option allows the control to be run in either the Manual mode via a speed pot or the Auto mode via the 4-20 ma. signal. The current signal input can be either grounded or ungrounded. The board sets on spacers screwed to terminals P1-3, P1-4, and P1-5on the main board using long screws. The current source connects to the + and - two position terminal strip (P16-1 and -2) on the -7 option board.

This option includes a Balance trimpot which is used to scale the maximum speed in the manual mode. It is factory set so the maximum speed in manual equals the maximum speed in automatic.

The Linearity trimpot on the -7 option board is set at the factory for proper linearity, however this trimpot may need to be re-set after tuning the Max and Min trimpot settings on the control or if the Balance trimpot on the –7 must be reset for your specific application. If needed then refer to the setup procedure below.

Setting the Min, Max, Balance and Linearity Trimpots.

1. Preset the multi-turn Linearity trimpot and the Balance trimpot on the –7 option board full CW, set the Min trimpot full CCW and set the Max trimpot at about 50% rotation.
2. Input a 4 ma. current signal to the control and turn the Min trimpot CW to your desired minimum output voltage or to deadband (the point just before you begin to get an output).
3. Input a 20 ma. current signal to the control and set the Max trimpot to the desired maximum speed setting.
4. Switch the control to the Manual mode setting and adjust the Balance trimpot CCW as needed to attain your required manual mode maximum output speed. (Adjustable form 50 to 100% of maximum Auto mode setting)
5. Switch the control back to Auto mode. With 20 ma. still going to the control, turn the Linearity trimpot CCW until your output speed starts to decrease. Then slowly turn it back CW until you just reach your maximum speed setting.

*** Note:** This jumper wire is not used with some options. Consult factory if more than one option is being wired. Using the JU2 jumper wire when not required may cause permanent damage to the control.

-11 Option
Ten Turn Speedpot

Field installed - ordered as separate item
Available on "C" and "RC" models only

Provides for a finer control of speed. Installation is the same as the standard speedpot.

-15A Option
Extended Accel / Decel

Factory installed
Available on all models

Extends acceleration / deceleration to 30 seconds (linear ramp).

-36M / -38M Option

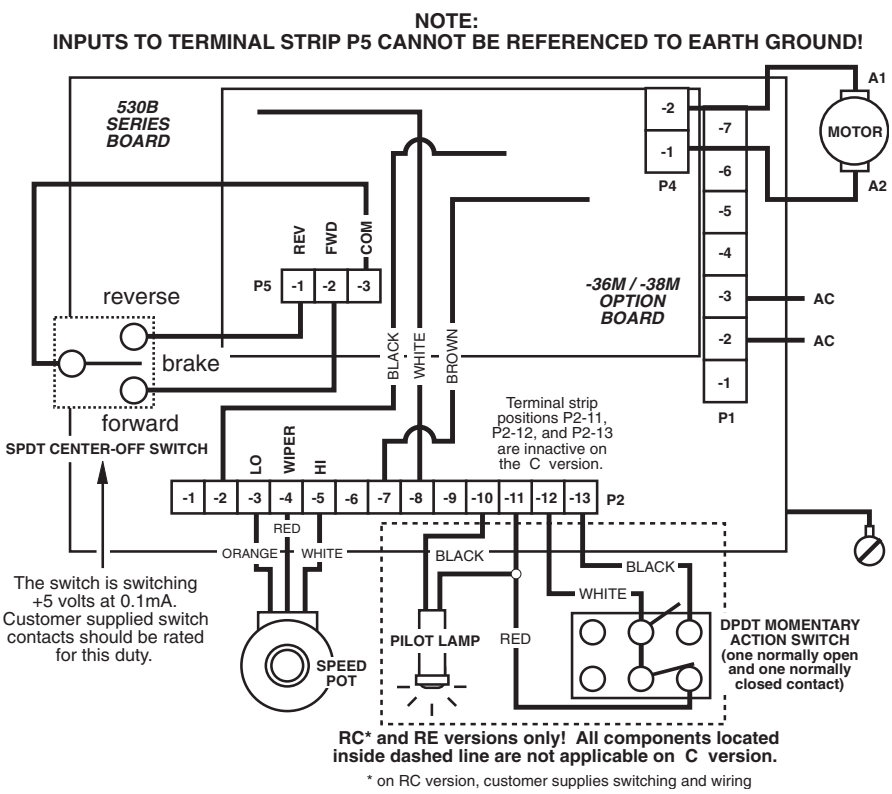
Forward / Reverse with Zero Speed Detect and Dynamic Brake

Factory or Field installed - see below
Available on all models except 3 H.P.

Option	AC Input	Installed	DBR Value	DBR location / placement
-36M	115VAC	factory or field	5Ω 30W	option board mounted
-36MA	115VAC	factory only	5Ω 50W	extrusion mounted
-38M	230VAC	factory or field	10Ω 30W	option board mounted
-38MA	230VAC	factory only	10Ω 50W	extrusion mounted

Warning: The addition of this option no longer allows for dual voltage operation of the 530B series board. The 115/230 VAC input selector switch (530B series board) must be set for the proper VAC input rating of the -36M/-38M option being used.

-36M / -38M HOOK-UP USING SPDT SWITCH OR CONTACT



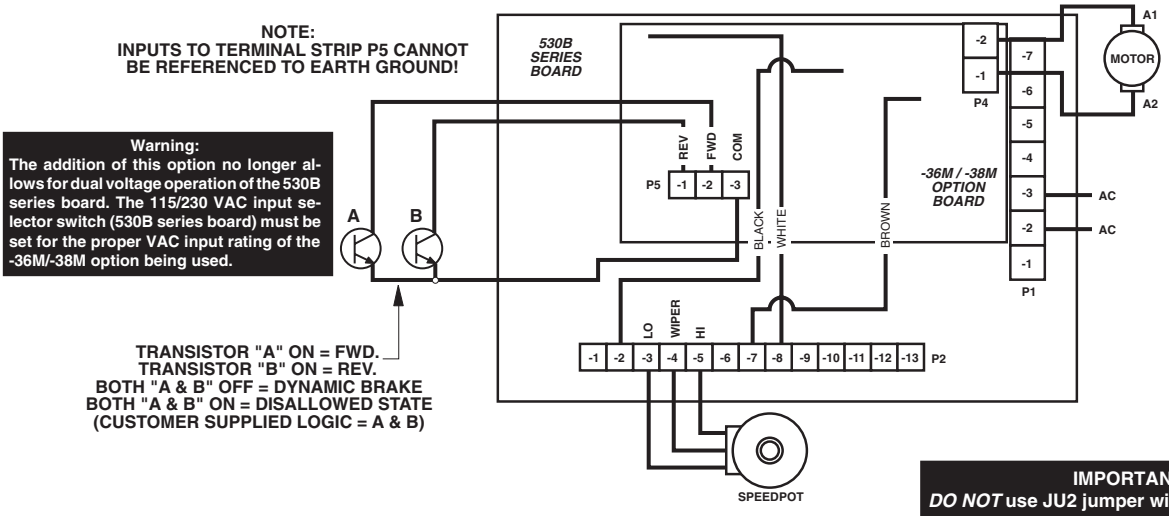
The -36M / -38M option automatically "brakes" to zero speed before reversing. The SPDT center-off switch is used to select direction. When the direction is reversed, relays K1, K2, and K3 connect the dynamic brake resistor to the armature. The motor "brakes" and at zero speed the relays reverse the armature leads, causing the motor to rotate in the opposite direction. When the switch is in the center (STOP) position, the motor armature is connected to the dynamic brake resistor.

Notes: The start-stop switch is customer provided on the "RC" version (see Hook-up Diagrams for switch wiring). The "RE" version requires a special cover that must be ordered for field installed -36M or -38M options. The Dynamic Brake Resistor is mounted accordingly per model (see above chart for placement).

VERY IMPORTANT:
DO NOT USE JU2 JUMPER WIRE with this option. WHEN RETROFITTING, JU2 JUMPER MUST BE REMOVED!!

To identify JU2 jumper location, see "Basic Hook-up Diagrams Without Options".

-36M / -38M HOOK-UP FOR NPN OPEN COLLECTOR DIRECTIONAL CONTROL



To identify JU2 jumper location, see "Basic Hook-up Diagrams Without Options".

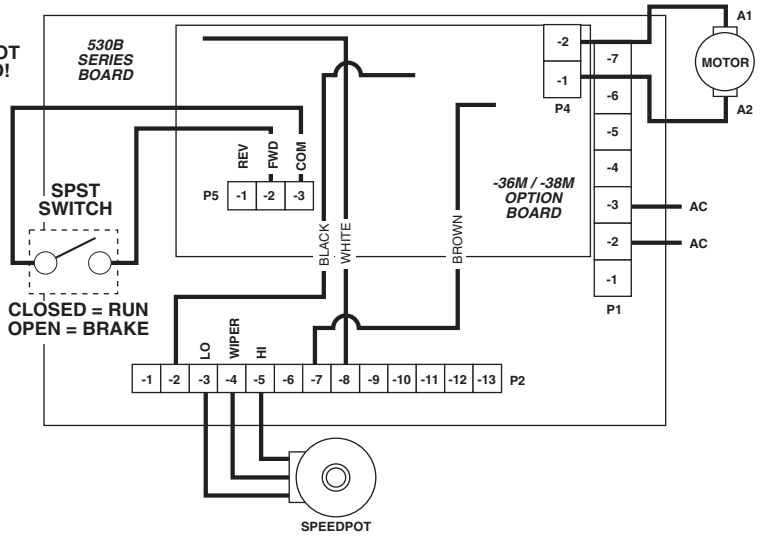
IMPORTANT:
DO NOT **use JU2 jumper wire with this option. When retrofitting, JU2 must be removed.**

(-36M / -38M option continued)

-36M / -38M HOOK-UP FOR UNIDIRECTIONAL RUN / DYNAMIC BRAKE

NOTE:
INPUTS TO TERMINAL STRIP P5 CANNOT BE REFERENCED TO EARTH GROUND!

Warning:
The addition of this option no longer allows for dual voltage operation of the 530B series board. The 115/230 VAC input selector switch (530B series board) must be set for the proper VAC input rating of the -36M/-38M option being used.



IMPORTANT:
***DO NOT* use JU2 jumper wire with this option. When retrofitting, JU2 must be removed.**

To identify JU2 jumper location, see "Basic Hook-up Diagrams Without Options".

IN CASE OF DIFFICULTY

PROBLEM	POSSIBLE CAUSE(S)	CORRECTIVE ACTION(S)
Motor doesn't operate	Blown fuse	Replace fuse
	Incorrect or no power source	Install proper service
	Speedpot set at zero	Adjust speedpot CW to start
	Worn motor brushes	Replace motor brushes
	Improper or missing jumpers	See "JU2 Jumper Wire Selection Chart"
Armature output voltage cannot be adjusted, output is a constant DC level	No motor or load connected	Check that the motor or load is connected to Armature terminals
	Speedpot low connection open	Check that speedpot low wire is connected
Motor stalls or runs very slowly with speed control turned fully CW	Low voltage	Should be above 104V or 208V
	Overload condition	Reduce load or re-adjust Current Limit
	Worn motor brushes	Replace motor brushes
	Max. speed set incorrectly	See "Adjustment Procedure"
Motor hunts	Too much IR Comp	See "Adjustment Procedure"
	Motor is in Current Limit	See "Adjustment Procedure"
	Motor speed is above rated speed	Reduce Max trimpot setting
Repeated fuse blowing	Overload condition	Reduce load
	Worn motor brushes	Relace motor brushes
	Defective motor	Replace motor
	Failed electrical components	Return for repair
Motor runs but will not stop	Incorrect wiring	Check "Terminal Strip Wiring" sections
	Defective wiring	Check wiring
	Failed component	Return for repair

After using this section, if control will still not operate, consult your Dart Distributor or Representative or return unit for repair.

FUSING

The motor and control are protected against overloads by the current limit circuit. Additional protection is provided through 2 fuses, which are mounted on the main board. Use exact fuse replacements if the fuse requires changing. Before changing fuses, be sure the power to the control is disconnected at the power source. Note: Both sides of VAC input are fused.

HP: 1/8 - 2.0 H.P.	**FUSE SIZE: 20 Amp**	**FUSE TYPE: Bussman ABC-20 or Little Fuse 314020**
HP: 3.0 H.P.	**FUSE SIZE: 20 Amp**	**FUSE TYPE: Bussman ABC-20 or Little Fuse 314020**

SPECIFICATIONS

AC INPUT VOLTAGE ..... ±10% of rated line voltage
ALTITUDE ..... Up to 7,500 feet above sea level
CONTROL OVERLOAD CAPACITY ..... 200% for 1 minute
DIMENSIONS & WEIGHTS:

	WIDTH	LENGTH	DEPTH	WEIGHT	TYPE
ENGLISH	6.70" 6.70" 6.70"	9.00" 9.00" 10.00"	2.25" 2.25" 4.75"	40 oz. 41 oz. 56 oz.	C RC RE
METRIC	171 mm 171 mm 171 mm	229 mm 229 mm 254 mm	51 mm 57 mm 121 mm	1134 gm. 1162 gm. 1422 gm.	C RC RE

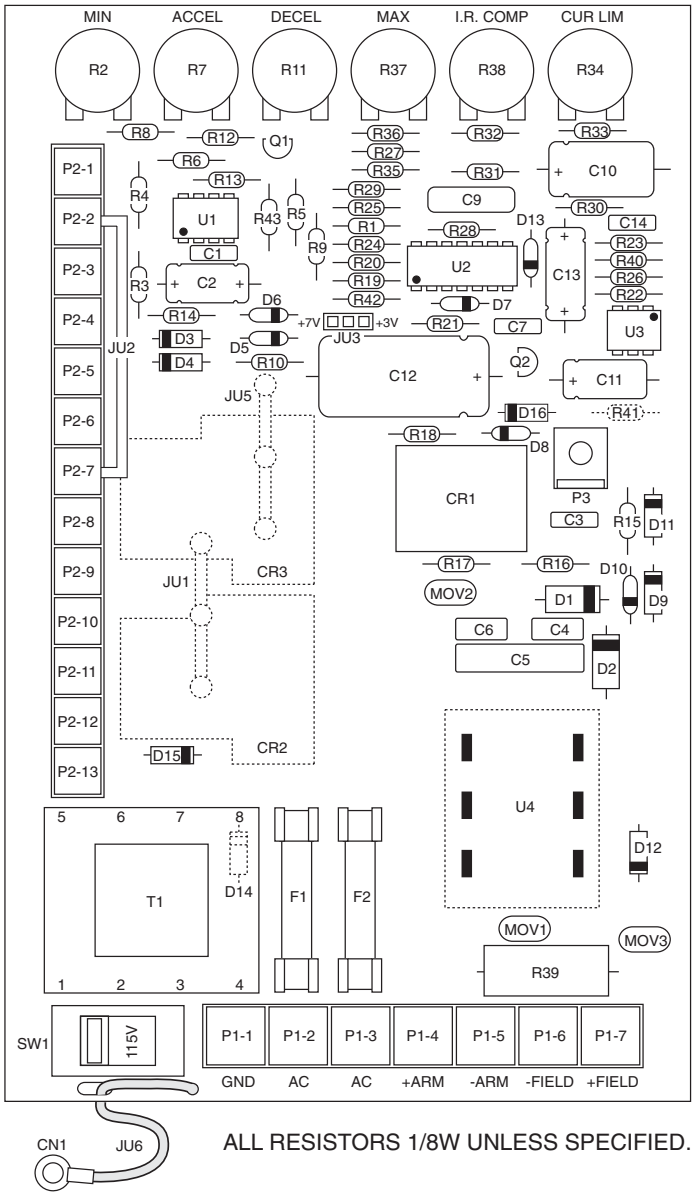
DRIVE SERVICE FACTOR 1.0
EFFICIENCY ..... 85% typical
ELECTRICAL SPECIFICATIONS - TYPICAL CURRENT & HORSEPOWER RANGES:

	115VAC INPUT / 0-90VDC OUTPUT		230VAC INPUT / 0-180VDC OUTPUT	
H.P.	MAX AC AMPS	MAX ARM AMPS	MAX AC AMPS	MAX ARM AMPS
1/8	1.80	1.40	------	------
1/6	2.60	2.10	------	------
1/4	3.50	2.70	1.80	1.40
1/3	4.40	3.40	2.20	1.70
1/2	6.50	5.00	3.30	2.50
3/4	9.30	7.20	4.80	3.70
1.0	13.20	10.20	6.50	5.00
1.5	21.50	14.70	9.70	7.50
2.0	--------	-------	12.90	9.90
3.0	--------	-------	22.00	15.00

FUSE PROTECTION ..... 2 AC line fuses (see "Fusing")
HUMIDITY ..... 99% non-condensing
INPUT FREQUENCY ..... 50 or 60 Hertz
MAXIMUM ARMATURE CURRENT - CONTINUOUS ..... 10 ADC (2 H.P.); 15 ADC (3 H.P.)
PILOT LAMP ("RE" VERSION) ..... Neon
POWER DEVICES ..... Packaged full wave bridge
SHUNT FIELD VOLTAGE ..... 100VDC for 115VAC in; 200VDC for 230VAC in; (1.0 A max. - 530B; 1.5 A max. - 533B)
SPEED CONTROL ..... Via 5KΩ Potentiometer OR 0 to +10 VDC isolated signal
SPEED RANGE 50:1
SPEED REGULATION ..... ±1% of base speed
TACHOMETER FEEDBACK ..... jumper selectable 3V or 7V per 1000 RPM
TEMPERATURE RANGE ..... -10° to 45° C. ambient (15° to 115° F.)
TRANSIENT VOLTAGE PROTECTION ..... G-Mov
TRIMPOTS:
- **ACCELERATION RANGE** ..... 0.3 to 12 seconds - adjustable
- **CURRENT LIMIT RANGE** ..... 1 to 20 Amps (1/8 to 2 H.P.)
  ..... 2 to 30 Amps (1.5 and 3 H.P.)
- **DECELERATION RANGE** ..... 0.6 to 12 seconds - adjustable
- **I.R. COMPENSATION RANGE** ..... 1/8 through 2.0 h.p. (530B controls)
  ..... 1.5 and 3.0 h.p. (533B control)
- **MAXIMUM SPEED RANGE** ..... 60% to 120% of base speed
- **MINIMUM SPEED RANGE** ..... 0 to 30% of maximum speed

TYPE RAMP OF ACCEL / DECEL ..... Linear

530B SERIES PARTS PLACEMENT & LIST



ALL RESISTORS 1/8W UNLESS SPECIFIED.

RESISTORS

R1	220K
R2	5K TRIM (MIN)
R3	47K
R4	300K
R5	10K
R6	4.7K
R7	250K TRIM (ACCEL)
R8	1K
R9	27K
R10	4.7K
R11	250K TRIM (DECEL)
R12	1K
R13	47K
R14	4.7K
R15	47Ω 1/2W
R16	91K 1/2W
R17	180K 1/2W
R18	470Ω
R19	47K
R20	6.8K
R21	300K
R22	1K
R23	47K
R24	470K
R25	10K
R26	680K
R27	22K
R28	2.2K
R29	1K
R30	220K
R31	390Ω
R32	390Ω
R33	39K
R34	1K TRIM (CUR)
R35	2.2K
R36	470Ω
R37	50K TRIM (MAX)
R38	100ΩTRIM (I.R.)
R39	.SEE BELOW
R40	100K
R41	SEE BELOW
R42	33K
R43	100K

ACTIVE DEVICES

Q1	2N4124
Q2	LM78L12 REG.
U1	LM358 IC
U2	LM324 IC
U3	3052 MOC
U4	L512F BRIDGE

CAPACITORS

C1	.01µF 63V
C2	1µF 50V N.P.
C3	.01µF 400V
C4	.01µF 400V
C5	.068µF 250VAC
C6	.01µF 400V
C7	.01µF 63V
C8	NOT USED
C9	.22µF 250V
C10	150µF 16V
C11	47µF 16V
C12	470µF 50V
C13	1µF 50V N.P.
C14	.1µF 63V

DIODES

D1	S6A4
D2	S6A4
D3	1N4005
D4	1N4005
D5	1N914B
D6	1N5233B
D7	1N914B
D8	1N5242B
D9	1N4005
D10	1N5233B
D11	1N4005
D12	1N4005
D13	1N914B
D14	1N4005
D15	1N4005
D16	1N4005

MISCELLANEOUS

CN1	CT60R16USB CONNECTOR
CR1	T73 RELAY
CR2	SEE BELOW
CR3	SEE BELOW
F1	20A FUSE
F2	20A FUSE
JU1	SEE BELOW
JU2	WC16WH2.5SL JUMPER WIRE (SEE MANUAL "JUMPER WIRES")
JU3	3 POS. MALE CONN. W/JUMPER
JU5	SEE BELOW
JU6	WC16GN3.5 WIRE
MOV1	275V G-MOV
MOV2	275V G-MOV
MOV3	275V G-MOV
PCB	A-4-2563C PRINTED CIRCUIT
P1	7 POS. TERMINAL STRIP
P2	13 POS. TERMINAL STRIP
P3	1/4" MALE SPADE PIN
SW1	115/230VAC SWITCH (DPDT)
T1	DST428 TRANSFORMER

-15A OPTION CHANGES

R13	180K

530BC CHANGES:

CR2	NOT USED
CR3	NOT USED
JU1	RLB2503S RAIL
JU5	RLB2503S RAIL
R39	.015Ω 5W
R41	1K 1/2W

530BRC CHANGES:

CR2	T9A RELAY
CR3	T9A RELAY
JU1	NOT USED
JU5	NOT USED
R39	.015Ω 5W
R41	NOT USED

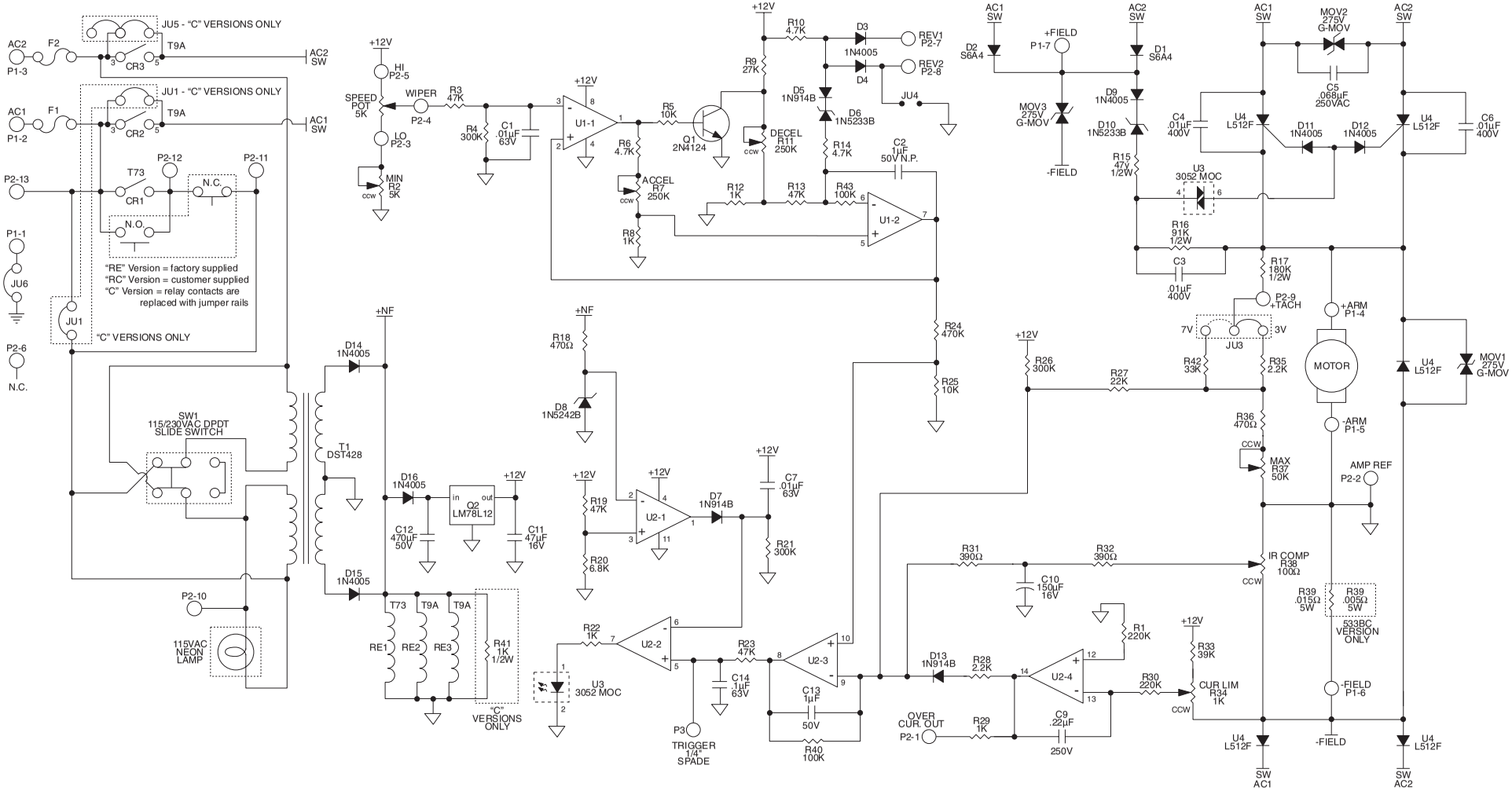
530BRE CHANGES:

CR2	T9A RELAY
CR3	T9A RELAY
JU1	NOT USED
JU5	NOT USED
R39	.015Ω 5W
R41	NOT USED

533BC CHANGES:

CR2	NOT USED
CR3	NOT USED
JU1	RLB2503S RAIL
JU5	RLB2503S RAIL
R39	.005Ω 5W
R41	1K 1/2W

530B SERIES SCHEMATIC



REPAIR PROCEDURE

In the event that a Product manufactured by Dart Controls Incorporated (DCI) is in need of repair service, it should be shipped, freight paid, to: Dart Controls, Inc., 5000 W. 106th Street, Zionsville, IN. 46077, ATTN: Repair Department.

Those orders received from anyone without and existing account with DCI will need to specify if they will be paying COD or Credit Card (Master Card or Visa). This information is required before work can begin. If you have an account with Dart your order will be processed according to the terms listed on your account.

Completed repairs are returned with a Repair Report that states the problem with the control and the possible cause. Repair orders are returned via UPS Ground unless other arrangements are made. If you have further questions regarding repair procedures, contact your Dart Controls, Inc. at 317-733-2133 Ext.460.

YOUR MOTION SYSTEMS SOLUTION PROVIDER

125D SERIES
AC INPUT - VARIABLE DC OUTPUT
1/50 HP through 1.0 HP

250G SERIES
AC INPUT - VARIABLE DC OUTPUT
1/50 HP through 2.0 HP

65 SERIES
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