

125DV CONTROL SERIES

DART

CONTROLS

Instruction Manual Adjustable Speed DC Control



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Models 125DV200E and 125DV12E

Please read and save these instructions. Read carefully before attempting to assemble, install, operate or maintain the product described. Protect yourself and others by observing all safety information. Failure to comply with instructions could result in personal injury and/or property damage! Retain instructions for future reference.

Description

The Dart line of enclosed, adjustable speed, DC motor controls are used for applications requiring constant or diminishing torque, such as conveyors, fans, blowers, etc.

It is designed to operate only one DC motor. This control is a general purpose, economical variable speed control for DC and universal motor applications. It features dual input voltages 120/230 VAC, power On/Off toggle switch, adjustable trimpot settings, terminal block connections, and packaged in a rugged Nema 4X enclosure.

Control Features

- MOV transient and surge protection
- Adjustable Accel and Decel (.5 - 8 seconds)
- Adjustable minimum and maximum speed limits
- Adjustable Current Limit
- Adjustable IR Compensation
- Line fused
- Power ON/OFF switch
- Power "ON" indicator
- NEMA 4X enclosure
- Forward/Stop/Reverse switch (optional)
- Dual Voltage 120/230VAC input
- Output Voltage 0-90/180Vdc
- 1% speed regulation
- Shunt field supply provided
- Overload capacity of 200% for 1 minute
- Available in Black or White

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.

Dart DC Motor Control

Dimensions

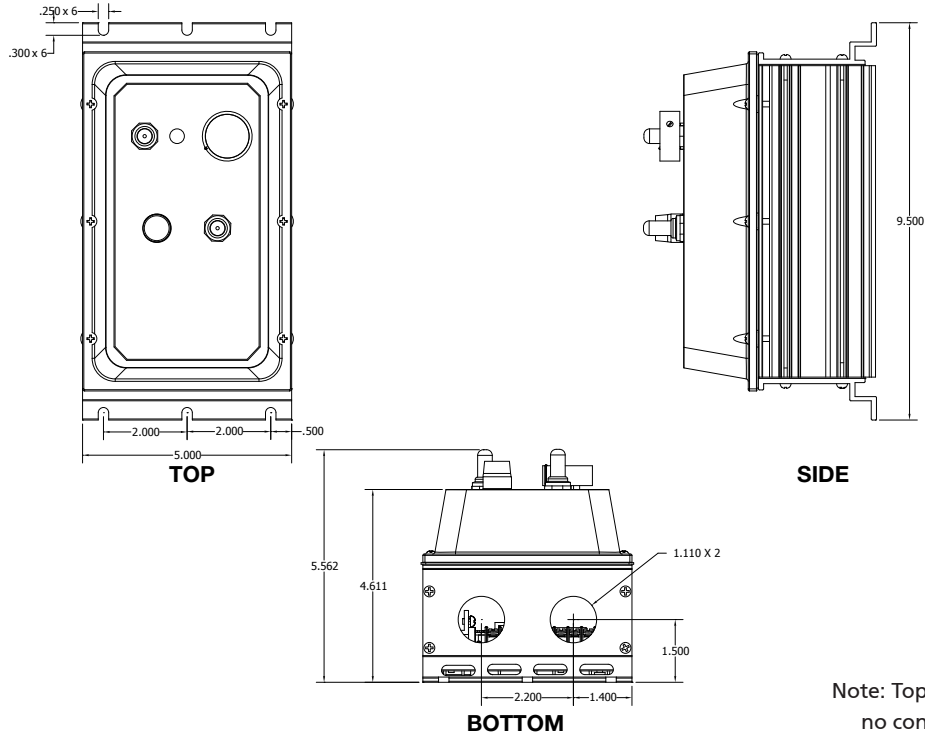


Figure 2

Model Table

MODEL	INPUT Vac	OUTPUT Vdc	OUTPUT Idc CONT.	HP RANGE	COLOR
125DV200EB	120/230	0-90/0-180	10A	1/8 - 1, 1/4 - 2	BLACK
125DV200EW	120/230	0-90/0-180	10A	1/8 - 1, 1/4 - 2	WHITE
125DV12EB	120/230	0-90/0-180	1.2A	1/50 - 1/8, 1/25 - 1/4	BLACK
125DV12EW	120/230	0-90/0-180	1.2A	1/50 - 1/8, 1/25 - 1/4	WHITE

Models 125DV200E and 125DV12E

Specifications

AC Input Voltage	120 VAC or 230 VAC \pm 10% Rated Line Voltage
Output	0-90Vdc (1/8 - 1 HP) or 0-180Vdc (1/4 - 2 HP)
Amps - Max Continuous DC Output	10 Amps
Input Frequency	50 / 60 Hertz
I.R. Compensation	Adjustable - full range
Max. Speed	Adjustable (60 - 110% of Base Speed)
Min. Speed	Adjustable (0 - 30% of Max)
Accel / Decel	Adjustable (.5 - 8 seconds)
Shunt Field Voltage5 Amp max, 100 VDC at 120 VAC .5 Amp max, 200 VDC at 240 VAC
Speed Control	5K Ohm Speed Potentiometer
Speed Range	50:1
Speed Regulation	\pm 1% of Base Speed
Temperature Range	-10° to 40° C. Ambient (15° to 105° F.)
Transient Protection	G-Mov
Agency Approval	cULus Listed under UL File # E204254
Dimensions	5.000" wide, 9.500" high, 5.562" deep
Weight	59.5 oz.

Application Information

If replacing another motor with this control and a DC motor, make sure that the full load torque rating of the DC motor is equal to, or greater than, the full load torque rating of the motor being replaced. Take into consideration how much starting torque is required.

If high voltage surges (transients) are present on the AC supply lines for the control, protect the control by installing an isolation transformer or other line filtering.

▲ WARNING

Do not operate the control near high capacitive discharge equipment such as electrical welders.

▲ CAUTION

Incorrect wiring and accidental grounds will seriously damage the control and/or motor and will void the warranty.

General Safety Information

▲ WARNING

Disconnect power before installing or servicing.

1. Lock and tag the power disconnect to "OFF" to prevent unexpected application of power.
 2. Follow all local and electrical safety codes as well as the National Electrical Code (NEC) and the Occupational Safety and Health Act (OSHA).
 3. Motor and control must be securely and adequately grounded. This can be accomplished by wiring with a grounded, metal-clad raceway system, by using a separate ground wire connected to the bare metal of the motor and control frame, or other suitable means. Refer to NEC Article 250 (Grounding) for additional information.
 4. Provide guarding for all moving parts.
 5. Do not touch the frame of an operating motor or control. When fully loaded they may run at very hot temperatures. Modern-designed motors and controllers normally run hot at rated voltage and load.
-

Dart DC Motor Control

6. Protect the power cable from sharp objects.
7. Do not kink the power cable, and never allow it to touch oil, grease, hot surfaces, or chemicals.
8. Make certain that the power source conforms to the requirements of your equipment.
9. Keep dirty cleaning rags and flammable waste materials in a tightly closed metal container or dispose of in the proper fashion.
10. If needed, clean the control enclosure with a mild solution.

Installation

⚠ WARNING

Do not install the control and motor where the atmosphere is (or may become) explosive.

⚠ CAUTION

It is strongly suggested that only qualified electricians or service people install, troubleshoot, maintain or service the control, motor, and interconnect wiring.

MOUNTING

1. Select a flat, rigid surface for mounting the control.

⚠ CAUTION

Avoid locating the control where vibration, temperature and/or oil will affect control operation or damage control components.

2. Refer to Figure 2 for mounting dimensions and layout mounting pattern on location selected.

NOTE: #10 bolts are recommended for mounting the control; these are not provided

Customer Hook-Up Diagram

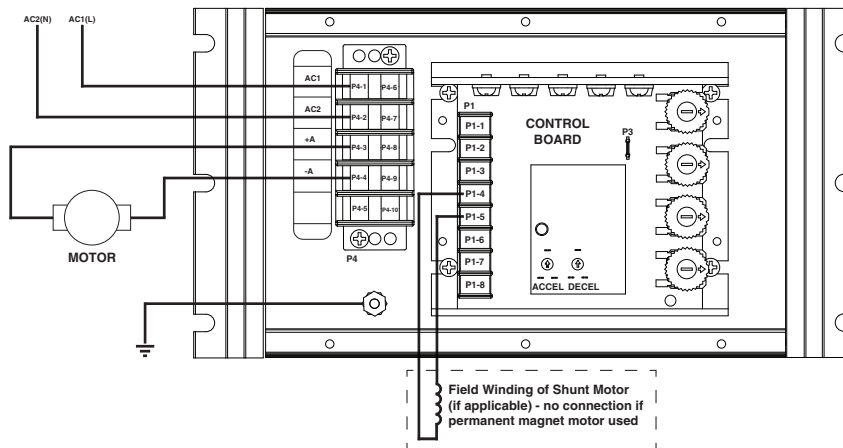


Figure 3 - Control Connection Diagram

Models 125DV200E and 125DV12E

▲ WARNING

Disconnect power source before connecting control or motor. Size motor armature and AC line conductors according to all national, state, and local codes. Minimum recommended wire size is "stranded" No. 14 AWG for control input lines, and for interconnecting lines between control and motor.

Make connections to the control and to the motor in accordance with the Connection Chart. Refer to Figure 3 for AC line and motor connections to the control terminal block that is located at the bottom of the control. To connect the AC line and motor, remove the front cover and support the cover (DO NOT strain the wiring).

CONNECTION CHART (See Figure 3)

These enclosures use a 5 position terminal strip for ease of connection.

AC1 (P4-1) and AC2 (P4-2)

120 VAC - Connect incoming hot AC or L (black wire) to AC1 (P4-1) and neutral AC or N (white wire) to AC2 (P4-2). Connect ground (green wire) to Gnd lug of control.

230 VAC - Connect one AC line to AC1 (P4-1) and connect the other AC line to AC2 (P4-2). Connect ground wire to Gnd lug of control.

+A (P4-3) Connect to the +Armature lead of the DC motor.

-A (P4-4) Connects to the -Armature lead of the DC motor.

+F (P1-5) 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 highest value is connected.

-F (P1-4) Connect to -Field of shunt wound motors ONLY.

▲ WARNING

Do not connect control AC power inputs to DC lines. Do not operate shunt wound DC motor with its field disconnected or de-energized.

FUSE SELECTION

The control is shipped with a ceramic 1/4 x 1-1/4" 15 amp line (250V) fuse. This provides correct protection for 1 HP 90Vdc or 2 HP 180Vdc motors. If the control will be used to drive a motor rated differently, then fuses sized per the Control Fuse Selection Table below may need to be installed for proper protection.

CONTROL FUSE SELECTION TABLE

HORSEPOWER	120 VAC INPUT	HORSEPOWER	230 VAC INPUT
1/8	2 AMP	1/4	2 AMP
1/4	4 AMP	1/3	3 AMP
1/3	6 AMP	1/2	4 AMP
1/2	8 AMP	3/4	6 AMP
3/4	12 AMP	1	8 AMP
1	15 AMP	1.5	12 AMP
		2	15 AMP

▲ CAUTION

Use only ceramic 1/4 x 1-1/4" (250V) fuses in the control, such as the Bussman ABC Series or the Littlefuse 314 Series. DO NOT use slow-blow fuses. Incorrect fuses (wrong current rating) will cause either inadequate control/motor protection, or nuisance fuse blowing.

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CUSTOMER WIRING

Type	Wire Range	Customer Wiring Temp Rating	Tightening Torque
Customer Terminal Wiring	22-14 AWG	300V, 75°C(167°F) minimum	9.0 lb-in (1.0 N-m)

CUSTOMER INSTALLATION WIRING REQUIREMENTS

- Do not mount DC drive where ambient temperature is outside the range of -10 to 45 °C (14 to 113 °F).
- Size all wires that carry armature or line currents as specified by applicable national, state, and/or local codes. All other wires may be 18AWG or smaller as permitted by the codes.
- Separate control wires from the armature and AC lines when routed in conduit or wire trays.
- These drives do not provide motor over-temperature sensing or motor overload protection. The need for additional motor overload and motor over-temperature protection shall be determined based on conditions in the end installation in accordance with the NEC.

BASIC CONTROL SETUP

1. Safety Precautions:
 - a. Observe the normal safety precautions for the voltages involved. It is strongly suggested that only qualified electricians or service people should install, troubleshoot, maintain, or service the control, motor, and interconnect wiring.
 - b. Be sure power is disconnected or shut OFF at fuse box or circuit breaker when installing the control and making adjustments (except running adjustments).
 - c. Remove the load from motor (or gearmotor) before running it.
 - d. Use an insulated screwdriver to make trimpot adjustments.

▲ CAUTION

When making running adjustments, be very careful not to touch any components except the adjusting pots.

2. On the control front panel, turn the control ON-OFF switch to off and set the control pot knob fully counterclockwise (CCW) and check line fuse.

NOTE: The fuse should be as specified by the Control Fuse Selection Table.

3. Check all the connections at the control terminals and at the motor. Make sure that they are tight and are made according to Figure 3 and the Connection Chart.
4. Rotate the motor's shaft manually to make sure it turns freely. A slight resistance may be noticed.
5. Turn the control ON-OFF switch to the ON position and then slowly turn the Speed Control knob clockwise (CW) while observing direction of motor rotation. If opposite direction of rotation is desired, correct by turning OFF the control and then reverse the motor armature connections.
6. With AC line power and control back ON, slowly turn Speed Control knob fully CW while observing the motor. Motor should accelerate smoothly to top speed.
7. Turn OFF control and AC power to control.
8. Reconnect the motor load that the motor will normally drive.
9. Turn AC power and the control back ON and adjust the trimpots (Figure 4) for the motor horsepower and voltage being used.
10. Test the control and motor under actual operating and load conditions; run the motor through the entire range of speeds required while it is fully loaded. Check motor speed with a tachometer.

Models 125DV200E and 125DV12E

	CL	IR	MAX	MIN	HP		CL	IR	MAX	MIN	HP	
INPUT 120 VAC					1/8	INPUT 230 VAC					1/4	
					1/4						1/3	
					1/3						1/2	
OUTPUT 0-90 VDC					1/2	OUTPUT 0-180 VDC					3/4	
					3/4						1.0	
					1.0						1.5	
<small>Operation of the control beyond $\pm 10\%$ of the normal line voltage could result in re-adjustment. These adjustments are permanent; periodic re-adjustment is normally not needed.</small>						<td>2.0</td>						2.0

Figure 4 - Trimpot Adjustment Chart

If control/motor performance is still not satisfactory, continue adjusting the control by following the procedures given in the next section, "Special Control Setup".

SPECIAL CONTROL SETUP

Use applicable sections of the following procedures if the "Basic Control Setup" procedures and the settings in Figure 4 do not provide satisfactory motor/control performance.

1. Follow the Safety Precautions given in paragraph 1 of "Basic Control Setup Procedure".

Max Setting

2. If a different maximum speed or voltage is desired, adjust the MAX trim pot (on circuit board) as follows:
 - a. Turn ON AC power to the control
 - b. Set Speed Control knob fully (100%) CW
 - c. Check motor speed and voltage with a tachometer and a DC Voltmeter.
 - d. Using an insulated handle screwdriver, adjust the MAX trim pot on the control PC board. (See Figure 5 for location.) Clockwise adjustment of the pot increases the maximum output to the motor; counterclockwise adjustment decreases the maximum output to the motor.

NOTE: Do not increase maximum motor speed above 1800 RPM for motors rated at 1725 RPM. Do not operate motor continuously above the rated DC voltage.

Min Setting

3. If a minimum speed is desired, adjust as follows:
 - a. Turn ON AC power to the control.
 - b. Turn Speed Control knob CCW as far as possible.
 - c. Check motor output speed or voltage
 - d. Adjust the MIN trim pot on the control PC board. (See Figure 5 for location.) Clockwise adjustment of the pot increases output to the motor; counterclockwise adjustment decreases.

NOTE: Typically the MIN pot should be set at Deadband which is the point in the CW rotation just before getting an output.

IR Setting

4. If better speed regulation is needed, then adjust the IR pot as follows:
 - a. Set speed at 50%
 - b. Check speed with Tach at no load
 - c. Apply normal load to the motor

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- d. Adjust the IR pot CW to increase speed regulation or CCW to decrease speed regulation until loaded motor speed is equal to unloaded motor speed.

CUR.LIM.

5. Limits DC motor current to prevent damage to the motor or control. CW rotation of this trimpot increases the maximum allowable armature current (or torque produced). To set:
 - a. Connect a DC current meter between A1 on motor and +ARM on the control (in series with the motor).
 - b. Set Speedpot at 50% or above.
 - c. Turn CL trimpot full CCW.
 - d. Stall and lock motor shaft so it can not spin.
 - e. With motor stalled, set current at 125% of rated motor current by adjusting C.L. trimpot CW.

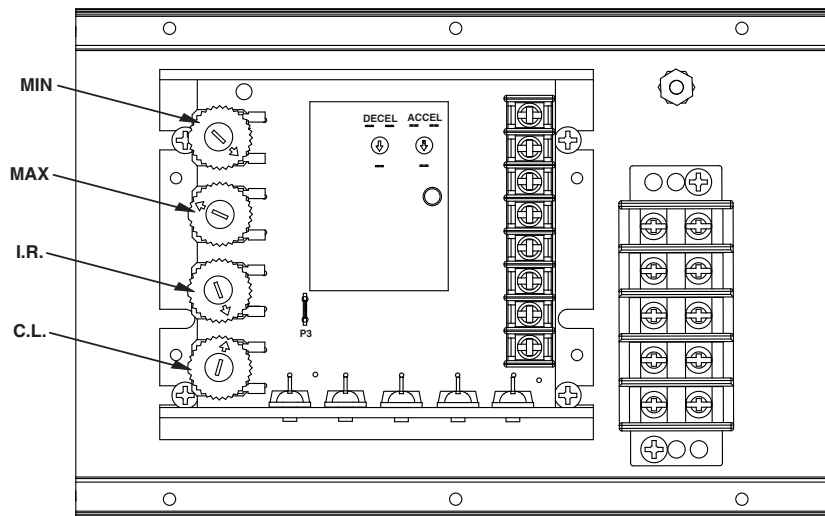


Figure 5 - Trimpot Location

ACCEL/DECEL

Individually Adjustable Linear Accel and Decel

6. These trimpots provide independently adjustable linear accel and decel from 0.5 to 8.0 seconds. Adjustment of both trimpots are accomplished via the labeled access holes on adder 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.

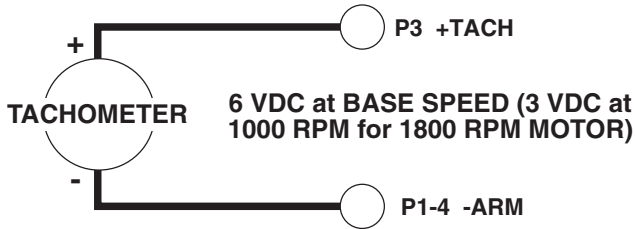
TACHOMETER

7. To utilize Tachometer (Tach) Feedback, the Tach Generator must provide 3V/1000 RPM.
 - a. Set the IR COMP Pot fully CCW when operating the control with a tach signal.
 - b. Reapply power to the control and run the control. Set the front panel speed control to 100% and adjust the MAX Pot for the desired base speed.

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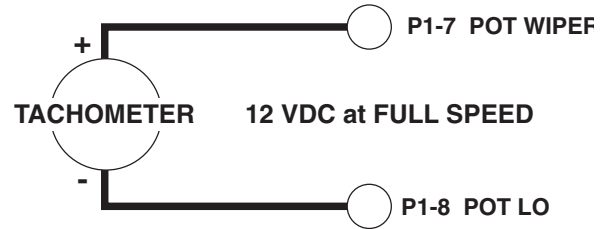
TACHOMETER FEEDBACK

Improves speed regulation to $\pm 1/2\%$ of base speed.



TACHOMETER FOLLOWER

Allows control output to follow tachometer voltage.



NOTE: If motor runs at maximum speed regardless of Speed Pot setting, Tach polarity may be incorrect or Tach may be inoperative.

OPERATION

PRECAUTIONS

⚠ WARNING

Do not operate the control in an explosive atmosphere.

⚠ WARNING

Do not operate the control near high capacitive discharge electrical circuits, such as electrical welding machines.

Regardless of motor speed, do not allow the torque load on the motor to exceed the motor nameplate full-load torque rating for extended periods of time.

OPERATING PROCEDURES

To start and run the motor, proceed as follows:

1. Perform "Basic Control Setup Procedure" first.
2. Turn "ON" AC power and place the control power ON/OFF switch in the "ON" position.
3. Change motor speed by adjusting speed control dial.

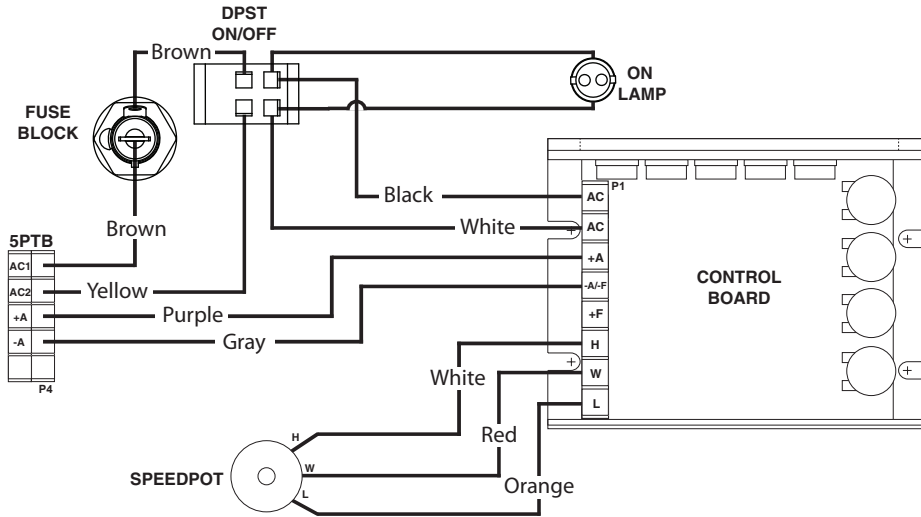
To shut down motor and control for longer periods of time, set the "ON/OFF" switch to the "OFF" position.

⚠ WARNING

Grounded armature circuit or shorted power device may cause motor to run at full speed.

Dart DC Motor Control

Internal Wiring Diagram



-4 OPTION (RUN/STOP/JOG)

This option provides a Run/Stop/Jog switch that gives the user a means to Stop the control when switched from Run to the center position. It also allows for a high speed momentary Jog option that can be used for clearing out or quickly resetting a system. During normal speed control operation via the speed pot dial, the switch should be set to the Run position.

-29 OPTION

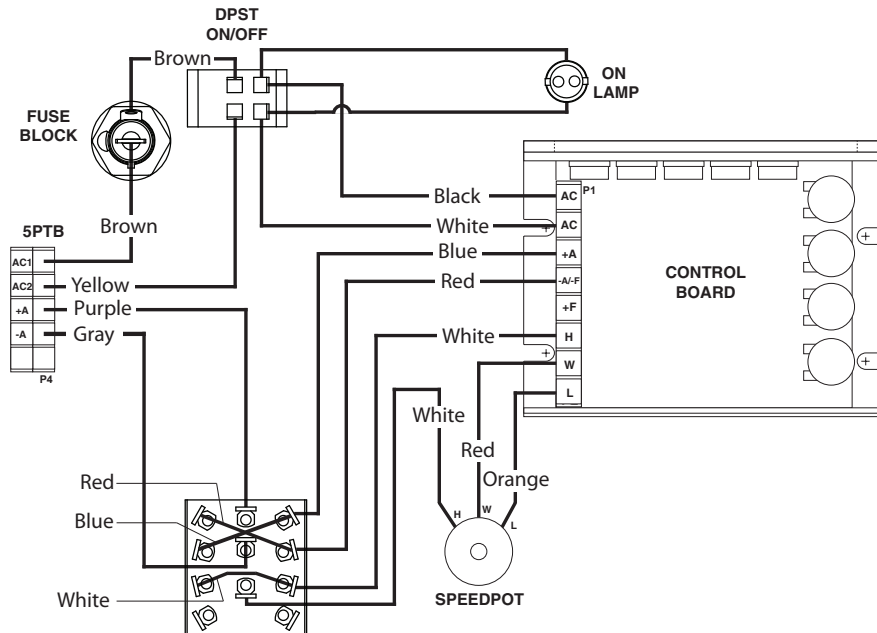
This option is a 4PDT mechanically center blocked switch that allows for a safe manual forward/stop/reverse operation of the motor while protecting against accidental plug reversing of the motor. The toggle switch has a mechanical block in the center STOP position that is activated any time a toggle from Fwd or Rev to the stop position occurs and is maintained until manual pressure is removed from the switch. While the switch is in the stop position the controller is electronically inhibited so that upon selecting a Fwd or Rev operation, the control smoothly restarts and accelerates to the speed set point without the hard start, surging, and overshoot experienced with typical switch or relay reversing.

⚠ CAUTION

When switching from FWD to REV, the motor must be given enough time in the stop position to allow for the motor to come to a complete stop before reversing. Failure to allow the motor to completely stop before reversing direction may result in serious damage to the control and/or motor.

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-29 Option Internal Wiring Diagram



-56H OPTION

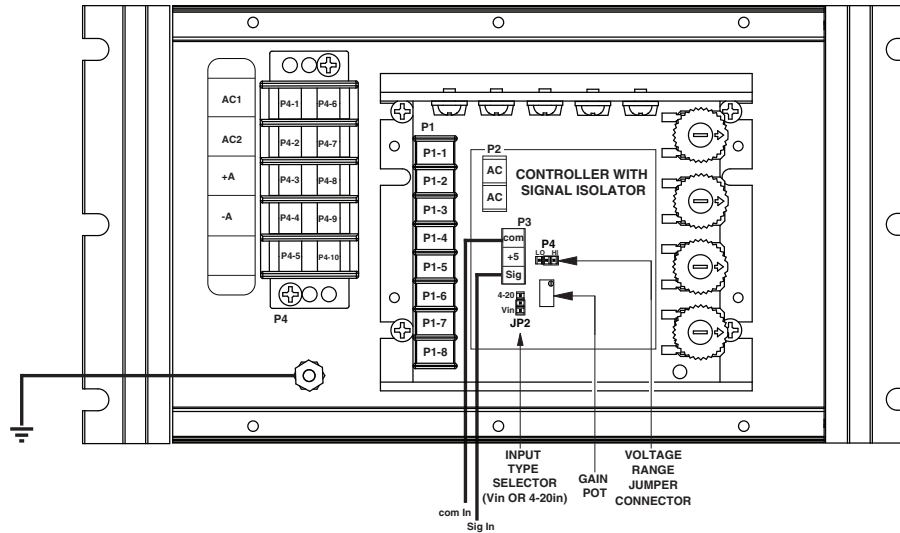
Auto/Manual Operation

Remote Signal Input with Auto /Manual Switch

This feature allows for the use of either a grounded or non-grounded remote DC signal such as 0 to 5 through 0 to 50Vdc, 4-20ma current or a remote speed pot. The DC input signal type can be selected for voltage (Vin) or current (4-20) via the JP2 jumper clip. There is a Hi/Lo range jumper selection that is set to the (Lo) setting when using a 4-20ma signal or for voltage ranges of 0-5 through 0-25Vdc. When using voltage ranges of 0-25 through 0-50 this jumper should be set to (Hi). The GAIN trimpot is used to set full linear output in reference to the input signal range. The output of this remote signal isolation board is a linear pulse width modulated signal that is proportional to the remote input signal that is being supplied.

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-56H Hook-Up Diagram



⚠ CAUTION

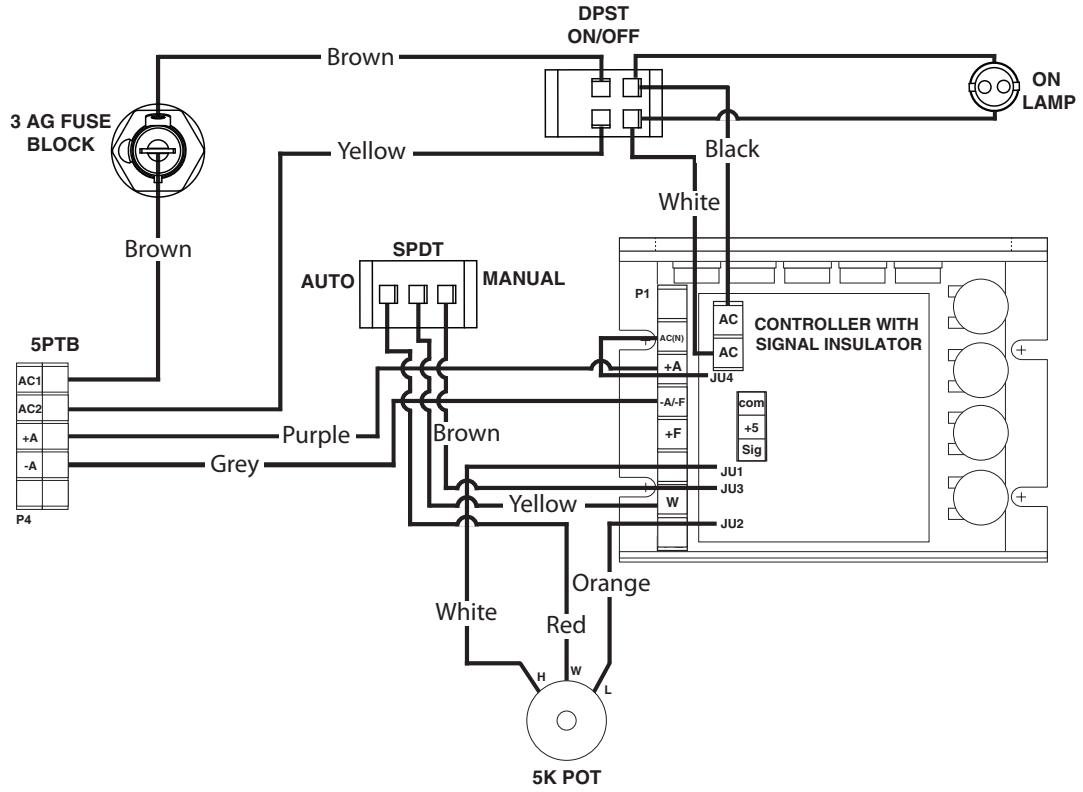
The Min and Max settings in the TRIMPOT ADJUSTMENT CHART may differ from the final settings achieved when using directions in following SET-UP PROCEDURES.

Set-up Procedure When Using Remote Signal Input In Auto Mode

1. With NO power to control, connect a DC Voltmeter 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 pot on the remote signal board fully CCW.
3. Place the JP2 jumper clip in the proper position based on the input signal being used.
4. Place the P4 jumper clip in the Lo position for 4-20ma signals or voltage signals less than 25Vdc. Place the P4 jumper clip in the Hi position for voltage signals greater than 25Vdc.
5. Make sure all connections are properly made per the hookup connection diagram in figure 3 and then apply AC power to the controller.
6. Make sure the Auto/Manual switch is set for Auto Mode and set the remote input signal to its lowest setting. Adjust the MIN trimpot to deadband (the point just before an increase causes an output).
7. Apply the maximum remote input signal. Motor should start to run. Adjust the GAIN pot CW until no further increase in control output voltage occurs and then decrease the gain pot slowly until output voltage to the motor drops approximately 5Vdc.
8. Set the MAX trimpot on the control to the correct motor voltage.
9. Some interaction between trimpots may occur. Recheck the Min trimpot setting and repeat steps 6 through 8 as needed.

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-56H Internal Wiring Diagram



Dart DC Motor Control

TROUBLESHOOTING

⚠ WARNING

Make certain that the power supply for the control is disconnected before touching any components inside the control, except when running adjustments must be made. If the AC power disconnect point is out of sight, lock it in the open position and tag it to prevent unexpected power application.

Only a qualified electricians or service people should install, troubleshoot, maintain, or service the control, motor, and interconnect wiring.

When making running adjustments, be very careful not to touch anything inside the control except the Trimpot adjusting screws; electrically "live" components are exposed, both on the front cover and on the internal panel. Use an insulated handle screwdriver to adjust the Trimpots.

OPERATING PROBLEMS

Most motor problems are caused by one of the following conditions:

1. Loose connections at control or motor.
2. Overloading motor.
3. Low voltage at control or motor input terminals caused by one of the following conditions:
 - a. Control AC input lines are undersized (conductors too small), or are too long for conductor size used.
 - b. Control DC output lines to motor are undersized or too long
4. Worn Motor Brushes

Always check connections, load, and supply circuits if motor fails to perform satisfactorily. Although the control is designed to operate on the AC voltage/frequency specified on its nameplate, it will also operate safely under normal motor loading conditions, on AC voltages/frequencies up to 10% higher or lower than that specified. For heavy motor loads, however, do not operate the control on AC voltages lower than the specified nameplate voltage. Some common causes of low voltage not previously mentioned are:

1. AC supply circuits overloaded by lights, electrical appliances, or other motors.
2. Low incoming line voltage caused by distribution system overloads.
3. Undersized AC lines in building where control is being used.

Some effects of low voltage are:

1. Motor power loss.
2. Slow motor starting.
3. Slow motor running (won't reach top speed).
4. Motor overheating
5. Frequent fuse blowing and/or circuit breaker tripping

NOTE: Effects 2 through 5 can also be caused by motor overloads.

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 Name, Shipping Address (no P.O. Box), Phone Number and if possible, e-mail address.

Those orders received from anyone without an existing account with DCI must specify if they will be paying COD or Credit Card (Master Card/Visa/American Express). This information is required before work will begin. If you have an account with Dart your order will be processed according to the terms listed on your account. Products with Serial Number date codes over 5 years old will automatically be deemed Beyond Economical Repair (BER). A new, equivalent device will be offered at a substantial discount.

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 Dart Controls, Inc. at 317-873-5211.

YOUR MOTOR SPEED CONTROL SOLUTIONS 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.

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