MDP CONTROL SERIES

DART CONTROLS

Instruction Manual

Field Programmable Closed Loop DC Speed Control

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IM-MDP-0200 (LTMD3/10)

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.

FEATURES & SPECIFICATIONS

- Microprocessor based, field programmable operating parameters for specific RPM ranges, FPM, GPM, Process time and other engineering units
- 1/8 DIN sturdy aluminum housing for panel mounting the MD10P
- 1/4 DIN sturdy aluminum housing for panel mounting the MD3P
- Large 4-digit 1/2 inch LED display
- Up and down push-button switches for set points - slow/fast sweep
- G.E. Lexan® membrane covers faceplate and seals push-button switches
- Screw type barrier terminal connectors
- Digital closed loop
- Non-volatile memory retains programmed setting upon loss of AC power
- Master-follower operation (via field programming change)
- Shipped factory set for 0-2400 RPM master mode with one pulse-per-revolution pick-up signal
- Uses hall-effect pick-up, photoelectric, magnetic (-3 option) or any TTL speed signal, capable of sinking 3mA
- 5000 pulses per minute - input maximum
- Programmable operating parameters: rate, follower or time mode, maximum and minimum set speeds, decimal point (rate or follower) or colon (time), constant for gear ratios
- Speed range - 25:1 minimum
- Accuracy ±1/2 RPM of set speed (time) - long term
- Resolution from 0.01 RPM
- Display in follower mode shows percentage of master, setable in 0.1% increments
- Inhibit circuit permits set-point pre-select and remote start-stop without breaking AC lines
- Self-contained power supply for AC incoming line and transducer (+5V DC, 50mA)
- Fixed acceleration, 2 to 4 seconds, load dependent
- The MD10P is U.L. Recognized (file # E78180) and C.S.A. Certified (file # LR85877)

OPERATING CONDITIONS

Input Voltage ..... 120 VAC ±10% (optional 240 VAC); 50/60 Hertz
Output Voltage ..... 0-90 VDC (optional 0-180 VDC)
Operating Temperature ..... -10° C. to 45° C. (15° F. to 115° F.)
Maximum DC Amperage ..... **(MD10P)** 4 Amps
..... **(MD3P)** 10 Amps
Maximum Horsepower ..... **(MD10P)** 1/3 H.P.with 120 VAC input; (2/3 H.P. with optional 240 VAC input)
..... **(MD3P)** 1 H.P. with 120 VAC input; (2 H.P. with optional 240 VAC input)
Maximum pick-up signal input voltage ..... 0 to 24VDC

OPTION DESCRIPTION

-3 option [1] ..... Option incorporates a divide by 1, 10 or 100 option board for use with a magnetic or Hall-effect pick-up.

-5 option ..... Factory installed option uses 240VAC 50/60 Hz. input voltage.

-13 option [2] ..... Factory installed combination incorporates a divide by 1, 10 or 100 option with provisions for remote up-down speed selection via push-button switches.

1) -3A option for the MD3P control
2) -13A option for the MD3P control

RATE, FOLLOWER & TIME MODE DESCRIPTION

The MDP Series controls are microcomputer based with field programming as a standard feature. This allows field setting for desired operating parameters in three different modes.

Rate Mode:

- Closed loop DC motor speed control which will control a standard 90 VDC PM motor (-5 option for 180VDC motor) and is capable of supplying 4 amps (MD10P) or 10 Amps (MD3P)
- Shipped factory set for 0-2400 RPM master operation (unit can be field programmed for your desired engineering units, feet per minute (FPM), gallons per minute (GPM), etc.).
- The accuracy of the control is ±1/2 RPM of the desired speed, long term
- A Dart Controls standard PU-E (hall-effect pick-up), photoelectric, magnetic (-3 option), or any TTL speed signal is needed for feedback from motor
- Push-button switches are used to change the set Rate*
  - push “UP” button up to increase Rate*
  - push “DOWN” button down to decrease Rate*
- In run mode the LED readout displays the set Rate*; in programming mode the parameter being adjusted is displayed

  * Note: For follower operation, display is always percentage of master

Follower Mode:

- The accuracy of the control is ±1/2 RPM of the desired speed, long term
- Two Dart Controls standard PU-E’s (hall-effect pick-up), photoelectric, or any TTL speed signals are needed for feedback (one pick-up from the motor and one pick-up for a master speed input signal)
- Push-button switches are used to change the set percentage of master;
  - push “UP” button up to increase percentage of master
  - push “DOWN” button down to decrease percentage of master
- In run mode the LED readout displays the set percentage; in the programming mode the parameter being adjusted is displayed

Time Mode:

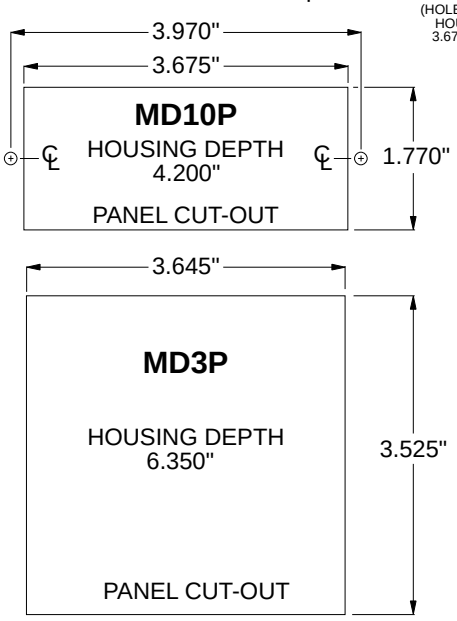
- Closed loop DC motor speed control which will control a standard 90 VDC PM motor (-5 option for 180VDC motor) and is capable of supplying 4 amps (MD10P) or 10 amps (MD3P)
- The MDP Series can be field programmed for your specific Process time and RPM requirements
- The accuracy of the control is ±1/2 RPM of the desired speed, long term
- A Dart Controls standard PU-E (hall-effect pick-up), photoelectric, magnetic (-3 option), or any TTL speed signal, is needed for feedback from the motor
- Push-button switches are used to change the set Time
  - push “UP” button up to increase Time
  - push “DOWN” button down to decrease Time
- In run mode the LED readout displays the set Time (in minutes and seconds); in the programming mode the parameter being adjusted is displayed

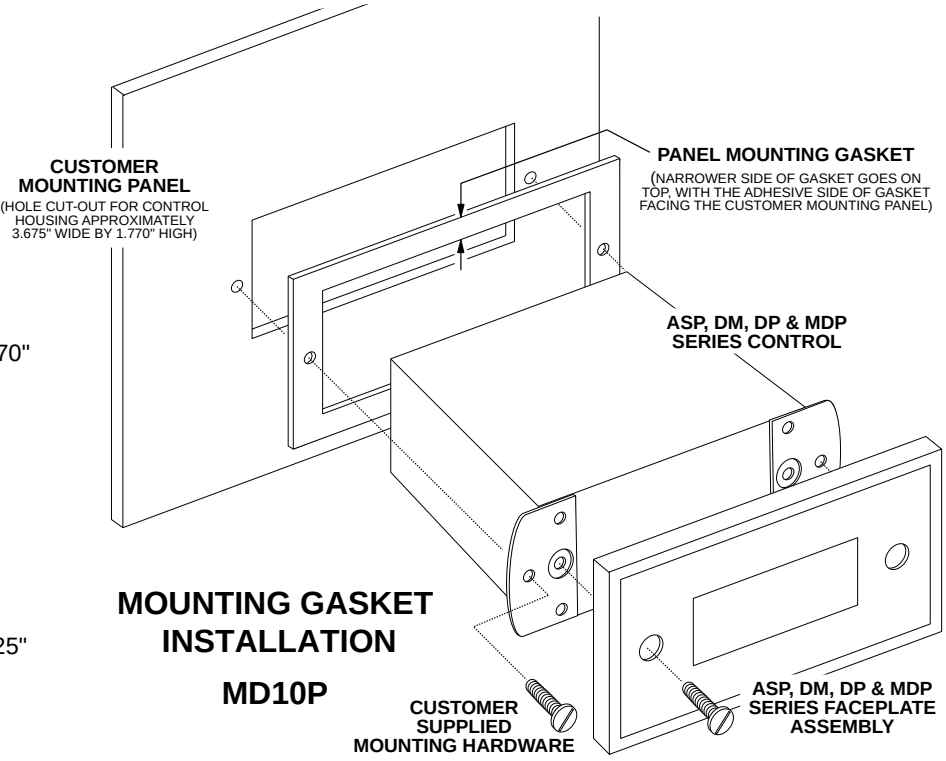
MDP SERIES INSTALLATION

MD10P INSTALLATION

Step 1: Remove two screws securing red lens.

Step 2: Mount the control into panel cut-out. Note diagram below for cut-out dimensions. Allow for easy insertion of control into panel.





Use caution when reinstalling red lens to prevent pinching of ribbon cable between lens and mounting panel.

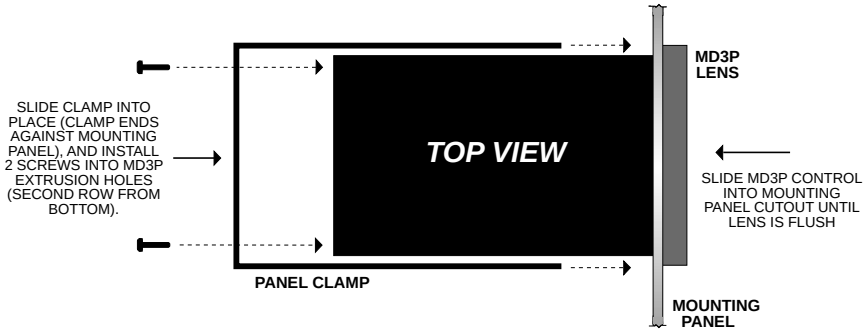
MD3P INSTALLATION

Step 1: Remove clamp from back of control.

Step 2: Slide the control into the panel cut-out. Note the diagram above for cut-out dimensions. Allow for easy insertion of control into panel.

Step 3: Secure control to panel by sliding clamp ends against mount ing panel backside (see diagram on next page).

Step 4: Install two (2) screws through clamp into extrusion holes and tighten (second row from bottom).

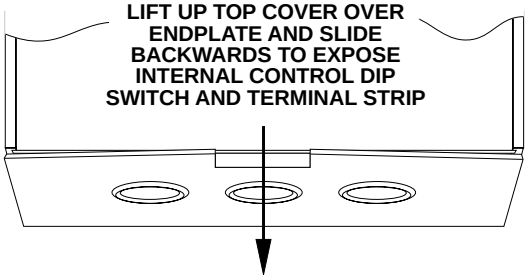


MD3P INSTALLATION

MDP SERIES DIP SWITCH ACCESS & DIMENSIONS

DIP SWITCH ACCESS

MD3P and MD10P



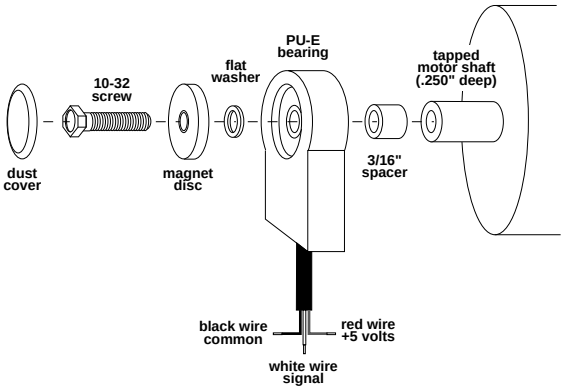
DIMENSION CHART

Model	*Width*	*Height*	*Depth*	*Weight*
MD10P English (inches)				
Housing	3.63	1.67	4.20	13.9 oz
Lens	4.40	2.25	0.25	0.9 oz
MD10P Metric (centimeters)				
Housing	9.22	4.24	10.67	393.3 gm
Lens	11.18	5.71	0.64	25.5 gm
MD3P English (inches)				
Housing	4.00*	3.50	6.35	33.3 oz
Lens	3.83	3.83	0.44	1.4 oz
MD3P Metric (centimeters)				
Housing	10.16*	8.89	16.13	924.4 gm
Lens	9.73	9.73	1.12	39.6 gm

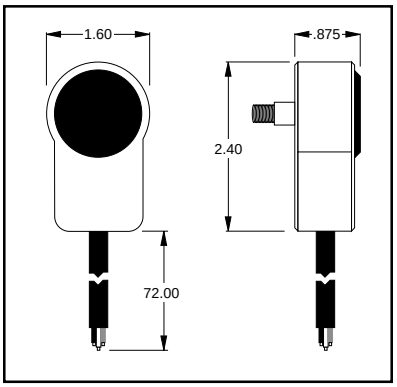
* includes clamp for housing dimension

PU-E SERIES PICK-UP INSTALLATION

The PU-E Series pick-up is an economical way to monitor motor speed. Its patented design provides for ease of installation in otherwise difficult to reach areas. The PU-E operates from a +5 volt square wave whose frequency is proportional to speed. This signal is fed into the MDP series control as a speed reference for the microprocessor.



model number	pulses per revolution
PU-2E	1
PU-4E	2
PU-10E	5
PU-20E	10



DIMENSIONS

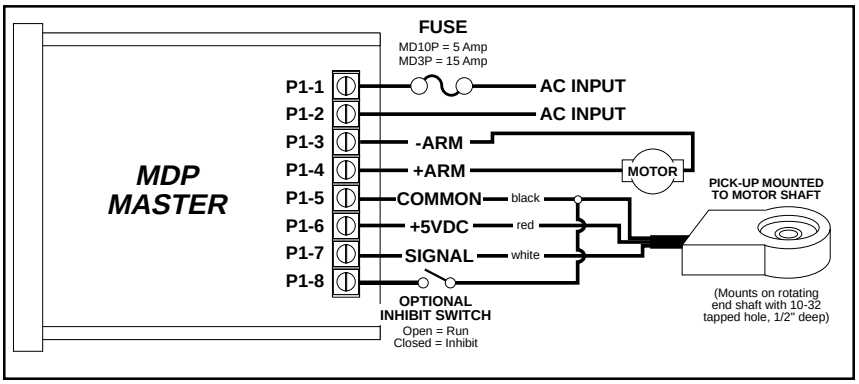
CAUTION: DO NOT OVER TIGHTEN MOUNTING SCREW !!

No other mounting screws are necessary, as the cord will keep the unit from rotating. The PU-E gives a high signal when the north pole of the magnetic disk crosses the hall-effect transistor. The signal is switched low when the south pole crosses the same transistor.

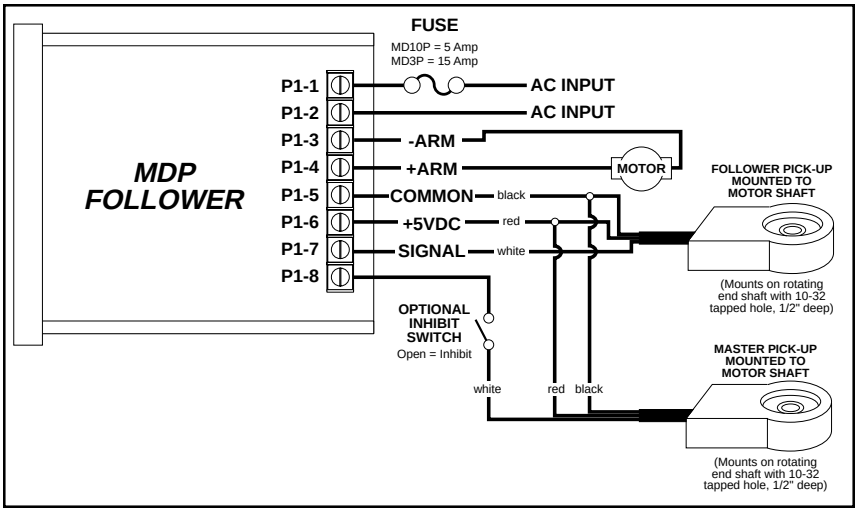
Caution: The PU-E cord should not be grouped with any other wires or cords. For applications with PU-E wire over 6 feet long, or noisy environments, a shielded cable is recommended. Connect the shield to the common terminal on the MDP series, leaving the shield on the PU-E end floating.

MDP SERIES HOOK-UP DIAGRAMS

HOOK-UP DIAGRAM - MASTER



HOOK-UP DIAGRAM - MASTER/FOLLOWER



STEP 1: Connect the proper input voltage to P1-1 and P1-2. Note: Fusing should be added in the AC line to protect the control. See the accompanying diagram for proper fuse size.

STEP 2: With AC power off, connect PU-E as shown in hook-up digram.

STEP 3: Connect the motor by attaching the -Arm to P1-3 and the +Arm to P1-4.

STEP 4: You are now ready to apply power to your system. If the motor is rotating in the wrong direction, turn the power off and reverse the armature leads.

Note: Shielded cable is recommended for applications where pick-up cord length is in excess of 6 feet.

Connect the shield to the common terminal of the MDP, leaving the shield at the pick-up end floating.

Caution: When the pick-up signal is lost, a master MDP will run at full speed, while a follower MDP will go to zero speed.

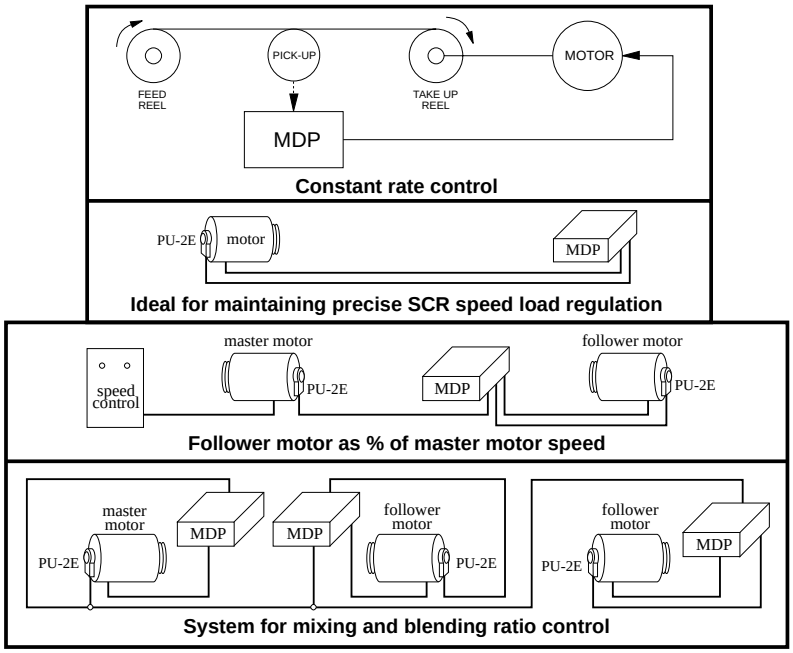
When master pick-up signal is lost (master-follower mode), a master MDP will run at full speed, while the follower will run at zero.

When follower pick-up signal is lost (master-follower mode), the follower MDP will run at full speed, while the master is unaffected.

For applications requiring rapidly changing loads and where quick recovery is needed, use the MDII series control.

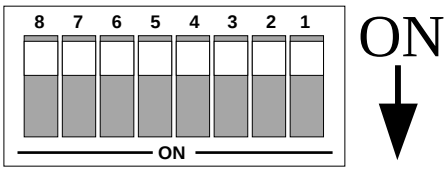
Warning: Do not attempt to perform a Hi-pot test across AC lines with the control in circuit. This will result in immediate or long term damage to the control!

MDP SERIES HOOK-UP CONFIGURATIONS



PROGRAMMING THE MDP SERIES

In order to program the MDP series, you must first gain access to the internal dip switch. To do this remove the top cover from the unit. The switch is located next to the transformer, facing the back of the control.



FORMULAS FOR CALCULATING THE "CONSTANT" VALUE FOR THE MDP SERIES

Before beginning to program you must calculate the constant that will be entered into the MDP. Use the appropriate formula below to find the constant number. **Note: Keep constant as high as possible for best resolution. Constant values less than 300 may result in slower reponse times and poor regulation!**

FOR MASTER RATE OPERATION:

$$\text{CONSTANT} = \frac{1500 \times \textit{"desired display setting"}}{\textit{"RPM of pick-up } \textbf{\textit{or}} \textit{ monitored shaft"} \text{ (at desired display setting)} \times \textit{"P"} \text{ (pick-up pulses per revolution)}}$$

Note: When programming and calculating the constant, ignore any displayed decimal points (i.e.. if the display shows 75.0 this is read as 750).

Example: We want to display the output shaft speed of a motor with a 2:1 gearbox. The *"RPM of pick-up* ***or*** *monitored shaft speed"* will be 800 and the *"desired display setting"* will be 400 (800 RPM through 2:1 gearbox = 400). We are using a Dart PU-2E pick-up (PU-2E provides one *"pick-up pulse per revolution"* - see page 4), so using the formula for rate:

$$\frac{1500 \times 400}{800 \times 1} = 750$$ Therefore, the constant programmed in is 750.

FOR FOLLOWER OPERATION: The constant is 1000 (Note: Display is in percent of Master).

FOR TIME OPERATION:

$$\text{CONSTANT} = \frac{\textit{"RPM of pick-up } \textbf{\textit{or}} \textit{ monitored shaft"} \text{ (at desired display setting)} \times \textit{"desired display setting"} \times \textit{"P"}}{1800}$$

"P" = pick-up pulses per revolution

Desired reading in minutes:seconds must be converted to seconds (i.e.. 1.29 = 89 seconds). The constant must be converted to minute:second (i.e.. a value of 97 derived from the formula would be entered as 1:37).
Note: Response time is directly related to the constant value. The lower the constant, the slower the response time will be.

DIP SWITCH FUNCTION TABLE

SWITCH 1	SWITCH 2	SWITCH 3	SWITCH 4	SWITCH 5	SWITCH 6	SWITCH 7	SWITCH 8
program constant	program minimum display setting	program maximum display setting	program displayed decimal point and rate-time select (0-4 = rate/follower/ decimal point; 5 = time mode/colon)	master-follower mode select off = master on = follower	do not use set to off	program-run mode select off = run on = program	do not use set to off

MDP SERIES FIELD PROGRAMMING

Note: While in Programming Mode, set decimal place/mode variable to the proper position (0-4 = Rate; 5 = Time). This allows settings to be made in the proper units (minutes:seconds vs. decimal numbers).

Note: You only need to set the variables that you wish to change, if any. You can change any variable WITHOUT having to reset the others. For example, if all you want to change is the upper limit, it is absolutely NOT necessary to set any other variable (constant, lower limit, decimal place).

Steps for setting up custom values for Constant, Lower Setting Limit, Upper Setting Limit, and Displayed Decimal Place

To Enter Programming Mode (motor will stop)

1. Make sure DIP switches 1, 2, 3, 4, 6, 7 and 8 are OFF.
2. Flip DIP switch 7 ON (This enters programming mode).
3. Display should read “Prog” (in rate mode the current decimal point is also displayed, a colon will be displayed between digits 2 and 3 in time mode).
4. Follow instructions given below to view and/or edit any of the desired variables.

To View or Change the Displayed Decimal Place, Rate or Time Mode Select

1. Make sure you are in Programming Mode, then flip DIP switch 4 (Program Decimal Place - Rate or Time Select) ON.
2. Present decimal point (if any) will be lit, as well as the current value of the decimal place variable.
3. Use Up and Down buttons to change, if desired. Use a value of 0 for NO decimal point, use a value of 5 for Time mode.
4. When finished, flip DIP switch 4 OFF.
5. Display should read “Prog” (the decimal point, if any, is also displayed). In time mode a colon will automatically light.

To View or Change the Constant

1. Calculate the constant for your application using the appropriate formula on page 5.
2. Make sure you are in Programming Mode, then flip Dip switch 1 (Program Constant) ON.
3. Present value for constant will appear in the display.
4. Use Up and Down buttons to change to needed setting.
5. When finished, flip DIP switch 1 OFF.
6. Display should read “Prog”.

Note: If you change the constant, the display setting will be set to the slowest speed when you exit the programming mode.

To Program for Follower Operation

1. Enter Programming Mode (switch 7 ON), then turn DIP switches 5 (Master-Follower select) and 1 (Program Constant) ON.
2. Set constant to 1000.
3. Turn OFF switches 1 and 7.

To View or Change the Program Minimum Setting

1. Make sure you are in Programming Mode, then flip DIP switch 2 (Program Minimum setting) ON.
2. Present value for lower limit will appear in the display.
3. Use Up and Down buttons to change, if desired.
4. When finished, flip DIP switch 2 OFF.
5. Display should read “Prog”.

To View or Change the Program Maximum Setting

1. Make sure you are in Programming Mode, then flip DIP switch 3 (Program Maximum setting) ON.
2. Present value for Upper Limit will appear in the display.
3. Use Up and Down buttons to change, if desired.
4. When finished, flip DIP switch 3 OFF.
5. Display should read “Prog”.

To Exit Programming Mode (return to RUN mode)

1. Make sure DIP switch 5 (Master-Follower mode select) is in the desired positions (On = Follower; Off = Master) BEFORE entering RUN mode (DIP switch 7 OFF).
2. Make sure DIP switches 1, 2, 3, 4 and 8 are OFF.
3. If satisfied with programmed values, flip DIP switch 7 OFF.
4. Control should begin to operate normally, using the values and modes you have programmed.

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.

ALSO AVAILABLE FROM DART CONTROLS, INC.

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

500 SERIES
AC INPUT - VARIABLE DC OUTPUT
1/50 HP through 3.0 HP

MDP SERIES
PROGRAMMABLE CLOSED LOOP DC SPEED CONTROL

DM SERIES
FIELD PROGRAMMABLE DIGITAL TACHOMETER

Dart offers the industry's broadest range of electronic DC and AC motor speed controls rated to 3 horsepower, as well as speed control accessories.

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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