Instruction Manual
Field Programmable Closed Loop DC Speed Control

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www.dartcontrols.com
The MD10P is U.L. Recognized (file # E78180) and C.S.A. Certified (file # LR85877)

- Self-contained power supply for AC incoming line and transducer (+5V DC, 50mA)
- Inhibit circuit permits set-point pre-select and remote start-stop without breaking AC lines
- Display in follower mode shows percentage of master, setable in 0.1% increments
- Resolution from 0.01 RPM
- Speed range - 25:1 minimum
- 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
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.

**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 mounting panel backside (see diagram on next page).
Step 4: Install two (2) screws through clamp into extrusion holes and tighten (second row from bottom).

**MDP SERIES DIP SWITCH ACCESS & DIMENSIONS**

<table>
<thead>
<tr>
<th>Model</th>
<th>Width (English)</th>
<th>Height</th>
<th>Depth</th>
<th>Weight</th>
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<tr>
<td>MD10P</td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Housing</td>
<td>3.63</td>
<td>1.67</td>
<td>4.20</td>
<td>13.9 oz</td>
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<td>Lens</td>
<td>4.40</td>
<td>2.25</td>
<td>0.25</td>
<td>0.9 oz</td>
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<tr>
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<tr>
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<td>393.3 gm</td>
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<tr>
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<td>0.64</td>
<td>25.5 gm</td>
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<tr>
<td>MD3P</td>
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<tr>
<td>English</td>
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</tr>
<tr>
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<td>924.4 gm</td>
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<td>Lens</td>
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<td>9.73</td>
<td>1.12</td>
<td>39.6 gm</td>
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* 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.

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

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 diagram.

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!
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 response times and poor regulation!

**FOR MASTER RATE OPERATION:**

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

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:**

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

“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.
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.

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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