



# MD10

*Engine  
Controller*

**Installation and User Manual for the MD10 Engine Controller.**

**Full Version**

File: MartinMD10rev1.4.doc May 16, 2002

## **READ MANUAL BEFORE INSTALLING UNIT**

### **Receipt of shipment and warranty return information**

Upon receipt of shipment, carefully remove the unit from the shipping container and thoroughly examine the unit for shipping damage. In case of damage, immediately contact the carrier and request that an inspection report be filed prior to contacting the COMPANY.

All returned items must be shipped prepaid and include a return material authorization (RMA) number issued by the COMPANY. RMA forms are available by contacting the COMPANY.

### **Limited Warranty**

The COMPANY (DynaGen Technologies Inc.) warrants the product with specifications as explained herein. The COMPANY shall repair or replace any MD10 controller, which prove to be defective under normal and proper use within three years from the date of shipment. This constitutes the only warranty and no other warranty shall be implied.

#### **For questions or comments regarding this product, contact:**

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# Table of Contents

<b>INTRODUCTION</b>	<b>4</b>
<b>SPECIFICATIONS</b>	<b>5</b>
<b>WIRING INSTALLATION GUIDELINES</b>	<b>6</b>
Wiring instructions, types and sizes	7
Wiring guidelines	7
Terminal description	8
Outline dimension drawing	10
General Wiring Diagram	11
<b>ADJUSTMENTS AND SETUP PROCEDURES</b>	<b>11</b>
Select the engine speed range	11
Starter Limiter Switch	12
Crank Disconnect calibration	12
Over-speed calibration	13
Auxiliary/Stop input	13
Failure Input	13
<b>SYSTEM OPERATING STATES</b>	<b>14</b>
Cranking State	14
Running State	14
Failure State	15
<b>LED INDICATIONS</b>	<b>16</b>
<b>TROUBLESHOOTING GUIDELINES</b>	<b>17</b>

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## INTRODUCTION

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The MD10 provides automatic start/stop and protection control for all types of engine-driven equipment. Simplicity of use, safety, features, versatility and over-all quality are paramount, providing the most cost-effective and reliable solution available. Ours came to be one of the smallest controllers available, with the best value per dollar-cost, backed by a 3 year warranty.

The MD10 maintains backward compatibility to the extent that it can replace similar products without substantial rewiring. Functionally, however, it is loaded with unique features:

- "No speed signal" detection: Should the frequency of the speed sensing signal go to zero while the engine is running, a No Speed Failure is asserted, and specifically indicated.
- Two selectable speed ranges: Allows for multiple speed signal use, such as 1) Magnetic pickup sensor, 2) Alternator output, 3) direct generator output connection.
- Differential speed sensing inputs (for twisted-pair connection): Very effective interference prevention by means of noise cancellation.
- Excellent EMI handling: Software detection of, and recovery from, noise corruption.
- REPLACEABLE RELAYS; Replaceable relays provided within on board sockets. Relays Rated 20 Amps at 30 VDC
- REPLACEABLE FUSE; On board replaceable 10A fuse, mini-fuse (standard automotive type).
- Reversed supply protection; No requirement for series diode on supply.
- 3.3V to 30V, -40°C. to +85°C. operation: Works anywhere; anytime .
- Zero Speed Restart™: Prevents starter pinion wear by ensuring that no engagement of the starter is possible unless the engine is stopped.
- Oil Bypass Failure: Waits 15 seconds from start before enabling Low Oil pressure monitoring. High Temp. input and Extra input are enabled immediately after start-up. Requires no user setting.
- Rest-Time indication: Provides feedback between crank attempts.
- SMALL SIZE; 3.302" x 3.342" x 1.842" 0.67lbs
- Provisions for multiple Start/Stop stations.
- Controller has 2 input features: 1). One for ground to start, 2). One for ground to stop.

## SPECIFICATIONS

<b>Operating VDC limits:</b>	3.3VDC min. - 30VDC max.
<b>Standby current draw:</b>	8mA
<b>Operating current draw:</b>	175mA
<b>Reverse polarity protected:</b>	Internal protection will prevent damage to unit under a reverse polarity condition. Re-connect power leads properly, and normal operation will resume.
<b>Speed sensing input accepts:</b>	Magnetic pickup Engine alternator Flywheel alternator Generator AC output directly
<b>Speed sensing maximum rating:</b>	Withstands Line voltage (300 V.A.C.)
<b>Operating temperature range:</b>	-40 <sup>o</sup> C ⇒ +85 <sup>o</sup> C
<b>Operating humidity range:</b>	0 ⇒ 95% non-condensing
<b>Fuel &amp; Crank contact output:</b>	10 Amps max. each Continuous sourcing(+bat) output. Kick back diode provided on fuel and crank output
<b>Pull Coil Output:</b>	300 mA Max (switches to +Vbat) Kick back diode provided on pull coil output
<b>Lamp Test terminal:</b>	Close to + Battery to test LEDs
<b>Actual unit weight:</b>	0.67 lb. (0.30kg)
<b>Shipping weight:</b>	1 lb. (0.45kg)
<b>Unit dimensions:</b>	3.302" x 3.342" x 1.8"
<b>Shipping dimensions:</b>	4" (10.16cm) x 4" (10.16cm) x 3" (7.62cm)

## WIRING INSTALLATION GUIDELINES

**Danger:** The controller does not generate a warning prior to engine start. Do not work on the engine while power is applied to the unit. It is recommended that warning signs be placed on engine equipment indicating the above.

### INSTRUCTIONS

Following these instructions will help avoid common installation problems during wiring and setup.

- Battery must be disconnected before any wiring connections are made.
- Wire length from the engine to the controller should not exceed 6 meters (20 feet).
- All failure inputs have a 3 second delay before shutdown occurs.

Wiring size and type should be as specified below. Use **stranded wire**, since solid wire has a tendency to crack, break and loosen over time.

### TYPES AND SIZES

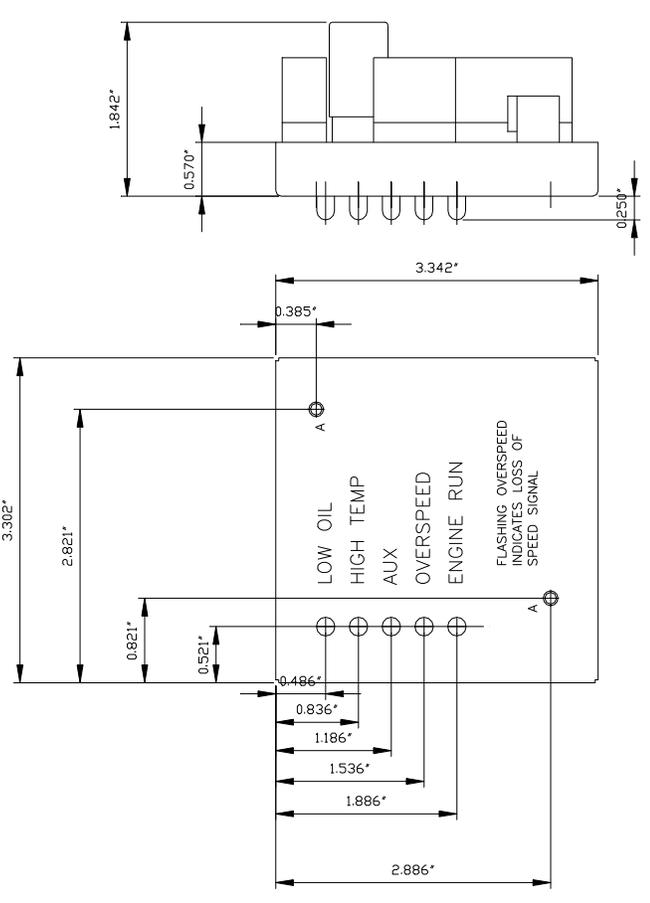
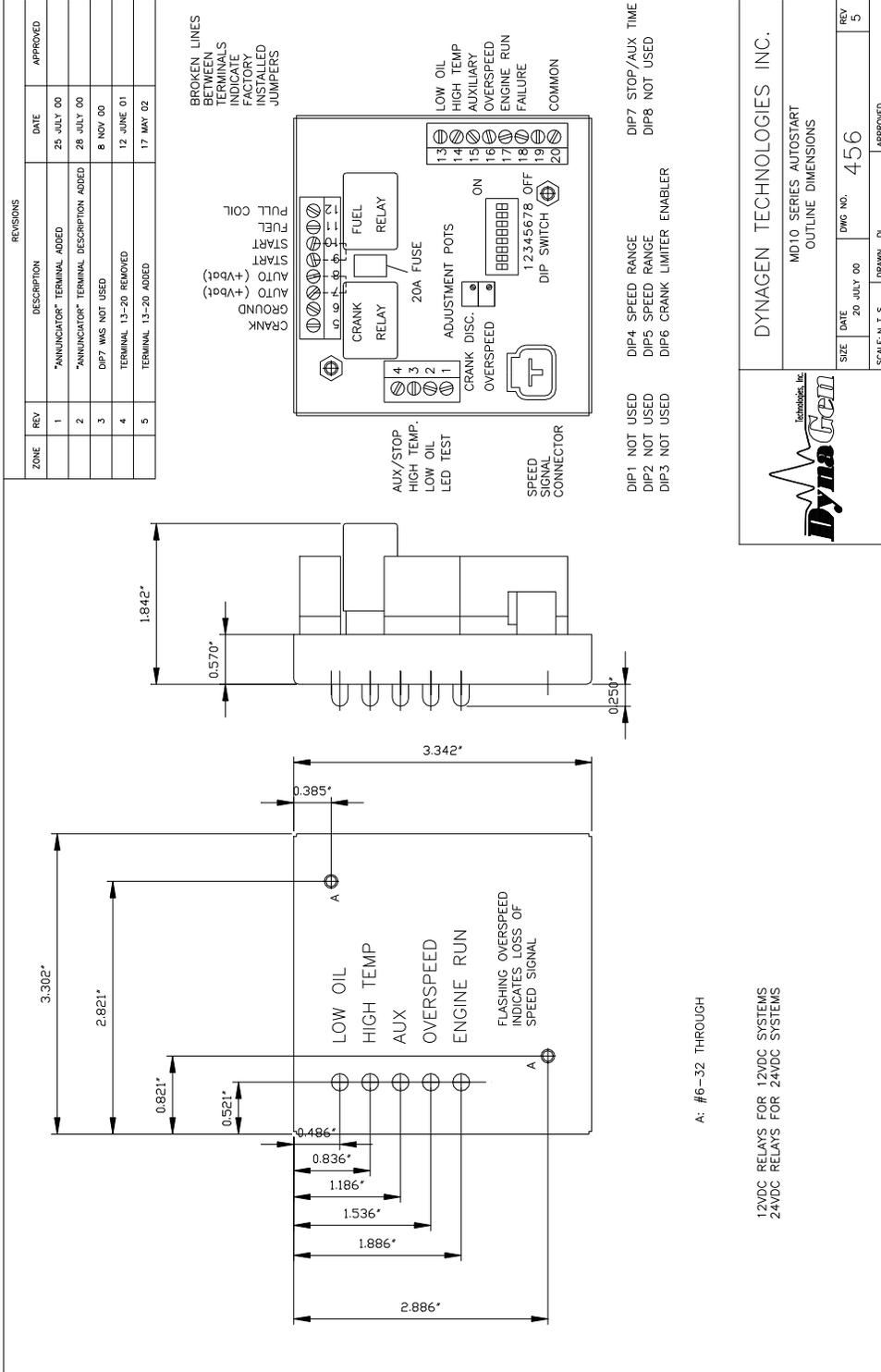
Terminal	Wire Size	Current max.	Function
CON 1	18	100mA	Speed signal connector (300 VAC max)
1	18	100mA	LED test switch
2	18	7mA	Oil pressure switch
3	18	7mA	Engine Temperature switch
4	18	7mA	Stop/Auxiliary Input switch
5	14	10 A	Starter Output
6	12	10 A	Battery negative (-)
7	18	10 A Fused	Auto (+bat)
8	18	10 A Fused	Auto (+bat)
9	12	10 A	Start input connection. Grounded input only
10	12	10 A	Start input connection. Grounded input only
11	14	10 A	Fuel output
12	18	300 mA	Pull coil output. Slave relay required
13	18	300 mA	Low Oil output
14	18	300 mA	High Temp. output
15	18	300 mA	Auxiliary output
16	18	300 mA	Over-speed output
17	18	300 mA	Engine Run output
18	18	300 m A	Failure output
19	N/A	N/A	Not Used
20	18		Common Ground. Not to be used as main Gnd.

## WIRING GUIDELINES

1. DO NOT use wire smaller than 18 AWG.
2. The connections supplying DC power to the MD10 panel should preferably run directly from the battery posts with no splices or other connections. Avoid, as much as possible, using chassis (aluminum or iron engine parts) as return conductor for battery negative voltage; copper wiring is recommended. Failure to follow the above may result in erratic operation, due to large voltage drops across wiring connections.
3. DO NOT short Crank output or Fuel outputs to ground, as this will cause on board 20 Amp fuse to blow and may result in damage to MD10 on board relays.
4. When replacing fuse, removable terminals and relays, only use factory recommended parts:
5. DO NOT use AC coil slave relays from controller outputs. Use intermediate relays of suitable size and coil rating.  
**NOTE: All MD10 engine controllers are shipped standard with 12VDC coil relays for +12 VDC systems. If the engine controller is used in a +24 VDC system, the onboard relays MUST be replaced with 24VDC coil relays.**
6. DO NOT exceed the maximum rated current and voltage on each of the controller outputs. Do not exceed 10 amps for each of the Fuel and Crank outputs, and 300ma for the annunciation and timer outputs.
7. The Pull coil output is internally protected against overload and short circuit (fault). Pull coil output energizes for 2 seconds after crank output energizes.
8. Two wires must be connected for the speed signal NOTE: A mating connector complete with 8 feet of cabling is provided as standard with each unit.
9. To verify the operation of engine controller outputs, measure voltage (i.e. meter in volts) when outputs should be ON, DO NOT measure current (i.e. meter in amps), this may cause damage to on board relays.

## TERMINAL DESCRIPTION

Term #	Description
CON1	Speed signal input for crank disconnect, engine run, and Over-speed sensing. Be sure to use twisted pair wiring for this connection. An 8 foot wiring harness is supplied as standard. 300 VAC max. input voltage.
1	Lamp test. Connect +12/24 VDC to lamp test to activate all the LED's.
2	Oil pressure switch. For proper operation, oil input must be connected to ground or +12/24 VDC via an oil switch. This switch <b>must</b> be the N.O. type, close on failure (low pressure)
3	Temperature switch. For proper operation, temperature input must be connected to ground or +12/24 VDC via a temperature switch. This switch <b>must</b> be the N.O. type, close on failure (high temperature).
4	The Auxiliary/Stop input. For proper operation, Aux. Input must be connected to ground or +12/24 VDC via a sensor switch. This switch <b>must</b> be the N.O. type, close on failure.
5	Crank output provides 10A maximum. Crank output closes to +12/24 VDC during cranking; opens when either the engine has started or during Crank Rest.
6	Battery ground connection for the controller module. A good ground connection, <b>directly from the battery</b> , is required for proper operation.
7,8	Auto terminal. When +12/24 VDC is applied, the controller is in the standby mode waiting for a Start/Stop signal (+12/24 VDC applied to Test).
9,10	(Start/Stop) terminal. When +12/24 VDC is applied, the controller proceeds to starting the engine.
11	Fuel output provides 10A maximum. Fuel output closes to +12/24 VDC when start signal is actuated, and opens when either an Engine failure is detected or when stop signal is applied.
12	The Pull Coil output provides 300mA maximum. Energizes 2 seconds after start signal is received from controller. Output closes to +12/24 VDC when activated.
13	Low Oil pressure output provides 300mA maximum. Oil output closes to +12/24 VDC when the engine shuts down due to a Low Oil pressure condition. Flashing Low Oil output indicates an Auxiliary Input failure.
14	High water temperature output provides 300mA maximum. Temperature output closes to +12/24 VDC when the engine shuts down due to a high temp condition.
15	Auxiliary fault shutdown.
16	Over-speed output provides 300mA maximum. Over-speed output closes to +12/24 VDC on an Over-speed failure and is open otherwise. Flashing output indicates Loss of Speed Signal.
17	Engine running output provides 300mA maximum. Engine Running output closes to +12/24 VDC when the engine starts (speed > crank disconnect setting), and opens when the engine stops. Flashing output indicates Crank Rest period.
18	Engine failure output provides 300mA maximum. Engine failure output activates on any failure (closes to +12/24 VDC when activated).
19	Not Used
20	Common ground- for annunciation outputs only. <b>DO NOT USE AS MAIN GROUND TO CONTROLLER UNIT.</b>



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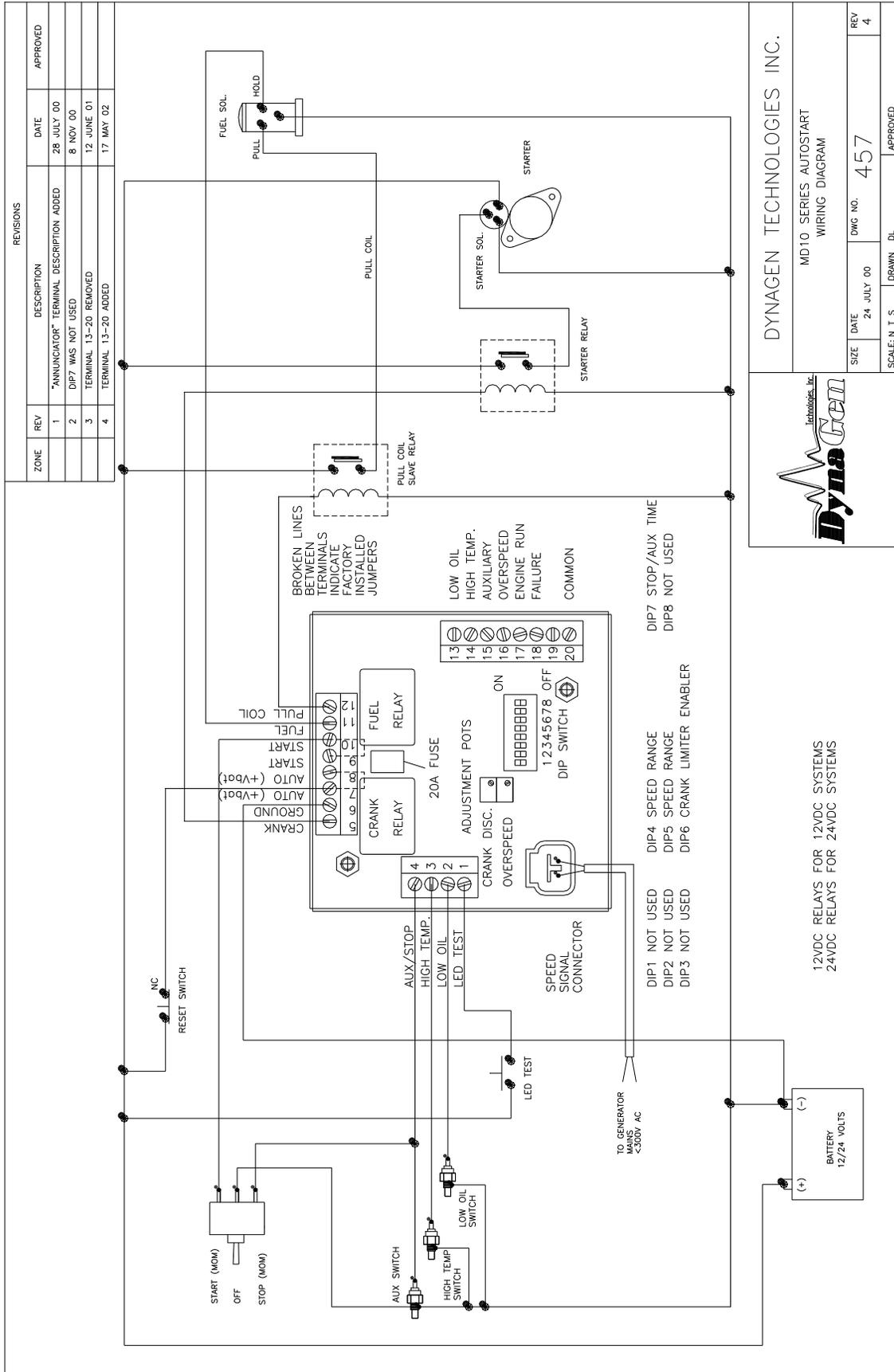
MD10 SERIES AUTOSTART  
OUTLINE DIMENSIONS

DATE	DWG NO.	REV
20 JULY 00	456	5

SCALE: N T S      DRAWN DL      APPROVED

12VDC RELAYS FOR 12VDC SYSTEMS  
24VDC RELAYS FOR 24VDC SYSTEMS

A: #6-32 THROUGH



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MD10 SERIES AUTOSTART  
 WIRING DIAGRAM

SIZE	DATE	DWG NO.	REV
	24 JULY 00	457	4

SCALE: N T S      DRAWN DL      APPROVED



## ADJUSTMENTS AND SETUP PROCEDURES

**Warning:** The following procedures will require engine operation. Be sure to follow all safety guidelines and wiring procedures.

**NOTE:**

“Potentiometer” is abbreviated as “pot” throughout. To increase a pot’s setting, turn it clockwise; to decrease it, counter-clockwise. These Pots are 25 turns nominal, therefore turn pots fully 25 turns to ensure that you are at either the minimum or maximum setting. The rear of the MD10 controller contains two adjustable pots, and eight DIP switches.

**Failure Bypass delay will occur for a period of 15 seconds** after the starter has disengaged and the engine is running (engine running LED on). After Bypass delay has expired, the engine controller then looks for failures such as Low Oil, High Temp, and Aux.

The steps for calibration of the MD10 controller to a specific system is as follows:

1. Select the Engine Speed Range ( DIP switches 4, 5)
2. Crank Limiter calibration (DIP switch 6)
3. Crank Disconnect calibration
4. Over-speed calibration
5. Auxiliary/Stop Input
6. Failure Inputs

### 1: SELECTING THE ENGINE SPEED RANGE

Two speed ranges are provided to permit greatest accuracy when adjusting Crank Disconnect and Over-speed settings. The speed ranges are selectable from DIP switches 4 and 5. The speed sensing input will be compatible with Martin alternator signal which is as follows:

Cranking Specs.	0.5Vrms, 50Hz
Running speed	8Vrms 325Hz

**NOTE:** To simplify installation all units will be pre-calibrated (pots and dip switches) to the most common settings as follows:

- Generator output speed range (Dip Switch 4 & 5 OFF)
- Crank disconnect 20Hz
- Overspeed 70Hz.
- Crank limiter OFF (Dip Switch 6 OFF)

Generator output: When using generator output coupled with a transformer (50 or 60 Hz) speed range 1 is required.

Engine Alternator: An engine alternator would require speed range 1 or 2. Refer to engine's specification for pulley ratio and number of poles before selecting range.

Magnetic pickup: A magnetic pickup would require speed range 2.

The speed range settings are as outlined in the table below.

Range	SW 4	SW 5	Crank Disconnect(Hz)	Over-speed(Hz)
1	OFF	OFF	12 – 140 Hz	44 – 300 Hz
2	ON	ON	60 – 4156 Hz	300 - 8492 Hz

## 2: Starter Limiter Dip Switch #6:

The Starter limiter feature provides a rest period for the starter system. This feature protects against starter overheating and damaged batteries. This Starter limiter can be either enabled or disabled by Dip switch 6. When Dip Switch 6 is in the ON position, the system works as follows:

When the Start Input activates, the unit proceeds to turning on the starter output. The Starter output energizes for a 15 seconds period, then proceeds to a rest period of 15 seconds. After the rest period the engine controller cranks the engine again for a full 15 seconds. This cycle continues until the engine has started or the user releases the start switch.

Once the speed goes above the crank-disconnect setting the starter output turns off, and the engine running LED turns on.

When Dip Switch 6 is in the OFF position, the system works as follows:

When the Start Input activates, the unit proceeds to turning on the starter output. The Starter output energizes as long as the Start switch is left in the start position. Once the speed goes above the crank-disconnect setting the starter output turns off, and the engine running LED turns on.

## 3: Crank Disconnect calibration:

The Crank Disconnect potentiometer adjusts the speed at which the controller safely disengages the starter. To adjust Crank Disconnect:

- b) Turn Over-speed pot fully **clockwise** 25 turns.
- c) Turn Crank Disconnect pot fully **clockwise** 25 turns.
- d) Remove wire connected to Fuel terminal #11 (Fuel/Ignition). For gasoline engines you may remove the wire from the spark plug.
- e) Initiate Cranking by applying a grounded signal to the Start terminal #10.
- f) Turn Crank Disconnect pot counter-clockwise until the green LED turns ON and Crank disengages (engine will stall due to missing Fuel/Ignition circuit). Turn Crank Disconnect pot fully clockwise one turn.
- g) Remove power from Auto terminal # 7.
- h) Reconnect wire to Fuel terminal # 11 (Fuel/Ignition) or reconnect spark plug wire.

**Note:** To proceed to step 7, you must ensure the controller positively detects engine start-up. If the running LED turns on momentarily and engine stalls (loss of speed: flashing Overspeed), try increasing the Crank Disconnect pot one full turn.

#### **4: Over-speed calibration:**

The Over-speed pot controls the speed at which an Over-speed failure shutdown is to be asserted. To adjust Over-speed

- a) Start engine by applying a grounded signal to the start terminal #10, allow engine to reach normal operating speed.
- b) Turn Over-speed pot counter-clockwise, slowly, until an Over-speed failure occurs.
- c) Remove power from Auto terminal # 7.
- d) Turn Overspeed pot approximately 1 to 2 full turns.

#### **5: Auxiliary/Stop Input: DIP Switch # 7**

The Auxiliary/Stop Input is DIP switch adjustable for failure.

- a). DIP Switch 7 ON: set to 3 seconds
- b). DIP Switch 7 OFF: set to 1 second

In the event of a failure, and the Auxiliary/Stop remains closed for the applicable Dip switch setting, the controller proceeds to monitor the Auxiliary/Stop for a period of 15 seconds. If at any time the Auxiliary/ Stop Input opens, the controller can be restarted by closing the Start input. If the Auxiliary/Stop input remains closed for 15 seconds, the Auxiliary failure LED is energized, and the controller is locked out from further starting.

#### **6: Failure Inputs:**

**NOTE:** The over-speed, low oil, and high temperature inputs must remain closed for a period of 3 seconds to initiate a failure.

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## SYSTEM OPERATING STATES

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There are 3 main operating states for the MD10 engine controller; they are as follows:

- A. CRANKING**
- B. RUNNING**
- C. FAILURE**

### **CRANKING:**

The Fuel/Ignition output **REMAINS ON** during the full Crank cycle –i.e. Crank and Crank Rest.

- The Starter output remains ON for an interval specified by the Crank/Rest Time pot, or until the engine ‘starts’ (reaches Crank Disconnect speed), whichever comes first. If and when the **engine starts**, the controller proceeds to **Running**.
- If the engine does not start (Crank time elapsed), Cranking stops, and a rest period follows (indicated by flashing running LED). At the end of this rest period, the Crank output activates again. Re-Cranking will continue until, either the engine starts, or the number of Crank attempts is equal to the set Maximum Crank Tries (Over-Crank failure).

### **RUNNING:**

When the controller enters the running state of operation, it monitors for failures such as:

- Low Oil (After *Oil bypass<sup>TM</sup>* period)
- High Engine Temperature (After crank disconnect period)
- Aux. Input failure (After crank disconnect period)
- Loss of Speed Signal
- Over-speed

The engine will continue to run until a failure occurs or in the event that power is removed from the Start/Stop terminal.

**FAILURE:**

The controller will enter the failure state if any of the following conditions occur:

- Engine Over-speed while running
- Engine Loss of speed signal while Running
- Engine Over-Crank failure
- Engine Low Oil pressure failure
- Engine High Temperature failure
- Engine Auxiliary/Stop Input failure

The failure state is a latched condition and power must be removed from the Auto terminal #7, before any servicing of the engine is performed.

## LED INDICATIONS

### FRONT PANEL LED INDICATIONS

What the LED's look like	Condition/Failure
No LED's ON.	"Ready" unit waiting for start signal, +12/24 VDC to Auto terminal. "OFF", no +12/24 VDC to Auto terminal.
Low Oil, steady	Low Oil Pressure Failure
High Temperature, steady	Over-temperature Failure
Aux. Steady	Auxiliary Failure
Over-Speed, steady	Speed Signal present above Over-Speed
Engine Running, steady	Engine Controller is in running mode of operation.
Over-speed flashing	Loss of speed signal Engine stall Engine overload Bad or broken speed signal
Engine Running, flashing	Crank-rest period. Cranking will resume soon

## TROUBLESHOOTING GUIDELINES

TROUBLE	POSSIBLE CAUSE	SUGGESTED ACTION
Unit does not operate when ground is applied to start terminal. Switch to start position	Power leads to unit are reversed	Confirm correct wiring for ground and +bat, and re-attempt testing.
	Bad ground connection from engine to controller unit.	Run wire directly from battery - to the ground terminal #6 on controller unit.
	No power to auto on unit	Check auto and place power to auto terminal if necessary
Engine starts and running LED comes on, immediately after the controller goes into over-speed	Over-speed pot setting too low	Refer to proper setup of over speed pot.
Engine does not crank	Battery is low or terminals are dirty	Clean terminals and re-charge battery (change battery if necessary)
	Crank circuitry wiring improperly connected	Measure the voltage at crank terminal. Ensure there is +Vbat. If not, replace on board relay. If +Vbat is available at engine controller, check wiring.
Engine cranks but does not start	Out of fuel	Check fuel level, add fuel if necessary
	Ignition control wiring not installed properly	Refer to engine control wiring section and check ignition connections
	Fuel relay damaged	Check fuel relay and replace if damaged.
Pull coil output does not activate	Short or overload on pull coil output	Remove short or overload on output. A slave relay may be required on overload fault. Max output is 300mA.
Engine starts, but running LED does not illuminate.	Improper speed range setting	Check to ensure that controller is set to proper speed range (Dip sw 4,5)
	fault(short or overload) on one of the annunciator outputs	check for fault, once fault is corrected then operation resumes.
	Speed signal harness may be defective, or bad connection.	Measure AC voltage available at speed signal harness.
Engine cranks and gets up to full speed, but starter does not disengage. Running LED then begins to flash indicating crank rest.	Speed signal improperly connected, missing, or damaged.	Check and correct speed signal wiring, or replace damaged speed signal source.
	Crank disconnect pot set too high	Re-calibrate crank disconnect pot.
	Wrong speed range	Check DIP switch settings 4 & 5